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A Study of the Noise Hazard to Employees in Local Discotheques

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ABSTRACT

Aim of Study: There is growing concern that amplified music in discotheques can cause hearing loss. This study attempts to evaluate the noise hazard of employees exposed to amplified music in our discotheques.

Method: Employees comprising of disc jockeys, bartenders, waiters, cashiers and security officers of five selected discotheques were used for the study. Personal noise dosimetry was carried out on 40 employees throughout their workshift. The audiometric examination results of another 46 employees were compared with 37 subjects from a non-exposed match control group.

Results: The range of exposure to noise level above 85 dBA for the employees is 3.6 to 6.9 hours with a mean of 5.1 hours. All the occupational groups are exposed to noise level of at least 89 dBA Leq for their whole work shift. The discotheque group has statistically significant higher prevalence (41.9 %) of early sensorineural hearing loss compared to the control group (13.5%). A higher proportion of employees in the older age group (above 30 years old) and working longer (above 1 year) suffer from hearing loss. A significant proportion of the discotheque study subjects (21%) also complained of recurrent tinnitus compared to 2.7% in the control group. The younger (< 30 years) and those with shorter exposure duration (< 1 year) appeared to complain of tinnitus more.

Conclusion: The study shows that all the employees regardless of occupations are exposed to noise above the permissible level of 85 dBA Leq A high proportion of them also suffer from early sensorineural hearing loss and tinnitus.

Keywords: discotheques, noise hazard, noise, hearing loss, tinnitus, amplified music

INTRODUCTION

There is growing concern that amplified music played in premises especially discotheques can cause hearing loss[1,2]. In Singapore, there has so far been one such study and this was on employees and musicians of nightclubs. The study was conducted by our department in the late 70s[3].

Our present study attempts to evaluate the noise hazard of amplified music on employees of our discotheques. Personal noise dosimetry was conducted for 40 employees from 5 selected discotheques. Another 43 of their employees were interviewed and had audiometric examinations carried out for them. Their medical examination results were compared with 37 subjects from a control group.

MATERIALS AND METHODS

Selection of discotheques

A list of 20 discotheques was drawn from the Public Entertainment Licensing Unit and the Singapore Telephone Directory. Questionnaires requesting information on their staff and operation were sent to them. Eight responded to the questionnaires. The others had either closed down or did not respond. After preliminary visits to all the eight, five were selected. The others were excluded because they are mainly operating as bar lounges or have less than ten full-time staff. All the selected discotheques also share similar operational characteristics. Business usually starts at 7 or 8 pm with songs and guest performances. The loud discotheque music, played by disc jockeys begins at about 10 pm and ends at 3 am.

Noise measurement

Noise dosimetry was carried out on 40 employees representative of 5 occupational groups. These included disc jockeys, bartenders, waiters, cashiers and security officers. Microphones were attached to the subjects' collars while the dosimeters were attached to their belts throughout the whole work-shift.

Medical examination

This was carried out in our department or quiet areas in the discotheque (eg. karaoke lounge, office) before operational hours. The noise levels of these areas were measured prior to the arrangement for the examination to ensure that they satisfy standards for audiometric tests[4]. Another group of 46 employees participated in the interview and medical examination. (We were not able to include all 40 who had noise dosimetry done as they were either not free or refused medical examination). They were interviewed regarding their medical and work history and exposure to other noise. Three were excluded because of

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exposure to industrial noise. This left us with 43 employees for the medical examination. They comprised of 25 waiters, 10 bartenders, 3 cashiers, 3 disc jockeys, 1 sound technician and 1 security officer. They work about 40 hours a week with 1 to 2 days off a week. The medical examination included auroscopy and audiometric screening. All were at least 14 hours away from loud noise before the test.

Thirty-eight students and office workers with no prolonged exposure to industrial noise and discotheque music were initially selected to be in the control group. They were matched with the study group on the basis of age, sex and race. After the interview, one subject with a history of ototoxic drug treatment was excluded from the control group. This left us with 37 control subjects who underwent similar medical examination.

Classifications of audiograms

The audiograms were classified according to the following criteria:

a) Normal:
   An audiogram with hearing threshold of less than 35dBA in all frequencies.
b) Early sensorineural hearing loss (ESHL):
   Elevation of hearing threshold to more than 30dBA at 4 and/or 6 kHz in either ear.
c) Severe sensorineural hearing loss:
   Elevation of threshold hearing to more than 30dBA at 4 and/or 6 kHz in either ear and average hearing threshold level at 1,2,3 kHz more than 50 dBA in the better ear.

For diagnosis of b) and c), air and bone conduction tests, must be compatible with sensorineural hearing loss, other conditions having been excluded on history and auroscopic examination.

Statistical analysis

Statistical analysis of the data was carried out with SPSS statistical package. Parametric and non-parametric tests of significance were carried out where appropriate.

RESULTS

Noise exposure levels

It is between 10 pm and 3 am that the noise exposure level goes above 85dBA. The range of exposure to above 85dBA for the employees is 3.6 to 6.9 hours with a mean of 5.1 hours. All the occupational groups are however exposed to a noise level of at least 89dBA Leq for their whole work shift (Table I).

Medical examination

General characteristics of the control and discotheque group

Table II summarises the characteristics of the discotheque and control groups. The discotheque group has a mean age of 23.9 years. Most of the employees have not worked long, with a mean exposure duration of 22.7 months (< 2 years). The maximum noise exposure was 108 months (9 years). The discotheque group has a higher prevalence (41.9%) of sensorineural hearing loss compared to the control group (13.5%). This difference was found to be highly statistically significant. A significant proportion of the discotheque group (21%) also complained of recurrent tinnitus. All these, despite the fact that the control group has a significantly higher proportion of people exposed to other loud noise such as firearms and walkman music compared to the discotheque group.

Types of hearing loss in the discotheque group

Eighteen (41.9%) of the employees have ESHL, of which 12 are unilateral. None of the study subjects has severe sensorineural hearing loss. One subject with conductive hearing loss was excluded from further statistical analysis.

Tinnitus, ESHL in relation to age and exposure duration in the discotheque group

The distribution of tinnitus and ESHL cases in relation to age and exposure duration is shown in Table III. The younger (< 30 years) and those with shorter exposure duration (< 1 year) complained of tinnitus more. On the other hand the highest proportion of ESHL cases are in those above 30 years old and with exposure duration of more than 1 year. However the association of age and exposure duration with ESHL and tinnitus respectively were found to be statistically not significant (Table IV).

DISCUSSION

Most investigators employed static measurements to estimate noise exposure risk in places playing amplified music[1,5,6,7]. Such studies however may not take into account the intermittent nature of the music played as pointed out by some authors[8,9], and the mobile nature of work of the employees. For our study, we measured the employees' noise exposure throughout their whole work shift using personal dosimetry. It shows that employees have noise exposure above 85dBA in the later period of their shift (mean of 5.1 hours). It also shows that all the employees regardless of occupations are exposed to noise above the permissible level of 85dBA Leq[10]. Our findings concurred with measurements using similar methods[9,11].

A significant 21% of the employees complained of recurrent tinnitus compared to 2.7% in the control group. Complaints of temporary tinnitus have been reported in rock musicians[12,13] and employees[11] exposed to amplified music. Our study shows that younger employees and those with shorter exposure duration complained more of tinnitus. This concurs with the observations of Taylor et al[14] and Gunderson et al[11] that newer employees tend to experience most tinnitus. It was postulated that long-term employees might have become desensitized to perception of tinnitus. However, the complaints of tinnitus should not be disregarded. It is an ominous sign that the noise exposure is too intense and if prolonged, can lead to permanent tinnitus[15,16].

Table I – Mean noise exposure in each occupational group

Occupational groups	No. surveyed n=40	Time-weighted average level (dBA)	
		Mean	Range
Security	8	89.6	75.0 – 97.4
Cashiers	5	90.3	84.2 – 99.9
Bartenders	10	91.3	85.4 – 96.0
Waiters	10	93.0	88.7 – 95.5
Disc jockeys	7	95.0	92.1 – 96.4

Table II – Characteristics of the control group compared to the discotheque group

Items	Control group n=37	Discotheque group n=43	Significance
Sex			
Male (%)	30 (81.1)	34 (79.1)	ns
Female (%)	7 (18.9)	9 (20.9)	ns
Race			
Chinese (%)	21 (56.8)	29 (67.4)	ns
Malay (%)	12 (32.4)	10 (23.3)	ns
Indian (%)	4 (10.8)	4 (9.3)	ns
Age (years)			
Mean ± SD	24.6 ± 6.8	23.9 ± 5.9	ns
Range	17 to 44	17 to 45	
Exposure duration (months)			
Mean ± SD	na	22.7 ± 29.1	na
Range	na	2 to 108	na
Other noise exposure[a] (%)	28 (75.7)	19 (44.2)	p = 0.011
Tinnitus (%)	1 (2.7)	9 (20.9)	p = 0.012
Sensorineural hearing loss (%)	5 (13.5)	18 (41.9)	p = 0.014

ns: not significant

na: not applicable, no exposure to discotheque noise

[a]: includes exposures to firearms, walkman and hi-fi music

Table III – DIstribution of cases with ESHL and tinnitus by age range and exposure duration in the discotheque group

	ESHL n=18	Tinnitus n=9
Age range (years)		
< 20 (n = 9)	2 (22.2%)	2 (22.2%)
20 – < 30 (n = 26)	12 (46.2%)	7 (26.9%)
⩾ 30 (n = 7)	4 (57.1%)	0 (0%)
Exposure duration (years)		
< 1 (n = 25)	10 (40%)	7 (28%)
1 – < 5 (n = 11)	7 (63.6%)	1 (9.1%)
⩾ 5 (n = 6)	1 (16.6%)	1 (16.6%)

Literature search so far revealed that much of the concern on the effect of amplified music on hearing ability is based on finding temporary threshold shift (TTS)[12,17-19] immediately after exposure. The relationship between TTS and permanent hearing loss is still unclear. To assess permanent hearing loss, we chose to minimise the effect of temporary threshold shifts by testing the study population at least 14 hours away from loud noise. Our findings of any hearing loss would be a better indicator of actual hearing loss.

As most studies are on TTS and the definition of "music induced deafness" differs in different studies, we chose to compare the hearing ability of our employees with a control group. Early sensorineural hearing loss (13.5%) was also detected in our control group. This has not been an uncommon finding in control[20] or general reference population[21,22] reported in other studies. The reasons given included cumulative exposure to social noise[21], subclinical hearing defect[22] and congenital hearing deficiencies[23].

Nonetheless, the prevalence of sensorineural hearing loss in the discotheque group is still statistically significantly higher than the control group. This is despite the fact that they have less exposure to other loud noise compared to the control group. A great extent of hearing loss for the discotheque group can therefore be attributable to prolonged exposure to discotheque noise at work.

Sensorineural hearing loss is positively associated with age and exposure duration to loud industrial noise[15]. In our discotheque group, a higher proportion of employees in the older age group (above 30 years old) and working longer (above 1 year) suffer from ESHL. However, this association between sensorineural hearing loss with age and exposure duration was found to be statistically not significant. This is probably because the majority of the employees are below 30 and at such age presbycusis is unlikely to play an important role.

None of the employee has hearing loss severe enough to interfere with perception of speech frequencies (ie. 1,2,3 kHz). The small sample size and short exposure duration (mean of 22.7 months) are probably contributing factors. So far there has been no report of severe sensorineural hearing loss from amplified music even in those with many years of exposure[24-26]. Rintelmann[7] suggested that individual susceptibility to amplified music is a more important factor in determining the degree of hearing loss. Hetu[26] and Axelsson[25] postulated that the intermittent and low frequency nature of amplified music, and even the psychological perception of the exposed may have resulted in mild hearing loss even after years of exposure. Another likely reason that needs to be mentioned is that the majority of such studies are based on small sample sizes. Longitudinal studies of more extensive nature would be useful to verify whether amplified music does cause severe deafness.

Table IV – Significance test for cases with tinnitus and ESHL with age and exposure duration, in discotheque group

	Diagnosis		Tinnitus	
	Normal	ESHL	Absent	Present
n*	24	18	33	9
Age (years)				
Mean	22.3 ± 4.89	25.85 ± 6.43	24.2 ± 6.3	23.3 ± 4
Median	22.5	23.5	22	26
p value	0.26		0.67	
Exposure duration (months)				
Mean	24 ± 34.4	20.9 ± 20.9	17.4 ± 24.8	24.1 ± 30.4
Median	11	9	10	9
p value	0.72		0.55	

* One employee with conductive deafness was excluded from analysis

CONCLUSION

Our study shows that the noise exposure levels of employees of discotheques are beyond the permissible exposure level of 85dBA[10]. A high percentage of the employees also experienced tinnitus and early sensorineural hearing loss, attributable to noise exposure during work in the discotheques. These hearing problems affect even the young and those who work for short durations. Although our study and those overseas did not reveal any severe hearing loss (for reasons mentioned in the discussion), measures need to be taken to minimise noise exposure. This is especially so, for those who wish to pursue a career in the music industry where an impeccable hearing acuity is important.

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