

**SENSORINEURAL HEARING LOSS IN YOUNG ADULTS WITH BMI OF 25 OR MORE**Shashikala K. T<sup>1</sup>, Srinivas K<sup>2</sup>**HOW TO CITE THIS ARTICLE:**

Shashikala K. T, Srinivas K. "Sensorineural Hearing Loss in Young Adults with BMI of 25 or More". Journal of Evolution of Medical and Dental Sciences 2015; Vol. 4, Issue 29, April 09; Page: 4997-5002, DOI: 10.14260/jemds/2015/728

**ABSTRACT: BACKGROUND:** A Body mass index [BMI] of 25 or greater is a significant health problem associated with a variety of disorders and in adults it has been found to be a risk factor for hearing loss. Higher BMI is independently associated with increased hearing loss. We investigated the hypothesis that young adults with a BMI of 25 or more are at increased risk of mild sensorineural hearing loss. **AIMS AND OBJECTIVES:** To assess hearing acuity in individuals with high BMI ( $\geq 25$ ) by audiometric assessment and compare it with the control group (BMI  $< 25$ ). **SETTINGS AND DESIGN:** A comparative and cross sectional study among volunteers residing in Bengaluru. **METHODS AND MATERIAL:** Data collected from 2 groups containing 30 participants each, test group contained individual with a BMI of 25 or more and the control group consisted individuals with BMI of  $< 25$ , in the age group of 18-35 yrs. Pure tone audiometry was carried out across various frequencies (0.5, 1, 2, 4, 6, 8 kHz) in both groups. **STATISTICAL ANALYSIS:** Student t-test was used to compare hearing thresholds across various frequencies in both groups. **RESULTS:** Compared to control group, high BMI ( $\geq 25$ ) was associated with increased pure tone hearing thresholds across lower frequencies (0.5, 1, 2 kHz). The degree of hearing loss is mild (26-40dB). **CONCLUSIONS:** This study demonstrates that young adults with a BMI of 25 or more are at increasing risk of mild sensorineural hearing loss.

**KEYWORDS:** High BMI, hearing loss, low Frequency hearing loss.

**INTRODUCTION:** In 2010, overweight and obesity were estimated to cause 3.4 million deaths, 3.9% of years of life lost, and 3.8% of disability-adjusted life-years (DALYs) worldwide.<sup>1</sup> Worldwide, the proportion of adults with a body-mass index (BMI) of 25 kg/m<sup>2</sup> or greater increased between 1980 and 2013 from 28.8% (95% UI 28.4–29.3) to 36.9% (36.3–37.4) in men, and from 29.8% (29.3–30.2) to 38.0% (37.5–38.5) in women.<sup>1</sup>

A BMI of 25 or greater is a significant health problem associated with a variety of disorders and in adults it has been found to be a risk factor for hearing loss.<sup>2</sup> Acquired hearing loss is a highly prevalent disabling chronic condition, which can impair communication, social interaction, and adversely affect psychosocial well-being and quality of life.<sup>3</sup> Therefore identification of potentially modifiable risk factors for hearing loss is a compelling public health goal.

Higher BMI is independently associated with an increased hearing loss,<sup>3</sup> a modifiable risk factor, and any disease process associated with it is preventable. Higher BMI is associated with poorer hearing sensitivities in a multinational European study<sup>4</sup> and a health ABC study.<sup>5</sup> Such a study is not conducted in Indian population.

In this study we investigated the hypothesis that young adults with a BMI of 25 or more are at increasing risk of mild sensorineural hearing loss.

## **OBJECTIVES:**

1. To assess hearing acuity in individuals with BMI  $\geq$  25 by audiometric evaluation.
2. To assess hearing acuity in subjects with BMI < 25 by audiometric evaluation.
3. To compare audiometry data of both groups and assess whether increased BMI is a risk factor for sensorineural hearing loss.

## **MATERIALS AND METHODS:**

### **1. Study type:**

- a. Comparative and cross sectional study.

### **2. Selection of Subjects:**

- a. The present study is conducted between two groups. The first group had individuals with a BMI of less than 25 (Control), and the second group had those individuals who had a BMI of 25 or more (Test). Each group has 30 subjects in the age group of 18-25years.
- b. The subjects were recruited on voluntary basis, the socio economic status, age were comparable between test and control groups.

### **3. Ethical Clearance:**

- a. Ethical clearance obtained from institutional ethical clearance committee.

### **4. Inclusion Criteria:**

- a. For controls:
  1. BMI: <25.
  2. Informed consent.
- b. For test group:
  1. BMI:  $\geq$ 25.
  2. Informed consent.

### **5. Exclusion Criteria:**

- a. For both test and control groups:
  1. History of chronic exposure to noise.
  2. History of short term exposure to loud noise (e. g. explosions, firearm noise).
  3. History of ear discharge, perforated tympanic membrane or any other chronic ear disease.
  4. Diabetes and hypertension.
  5. Organic or psychiatric illness.
  6. History of trauma to the ear.
  7. Family history of hearing loss.
  8. On medication [ototoxic drugs, sedatives within last 2 months].
  9. Smokers.

**6. Study protocol:**

- a. The study was conducted at Life Style lab, Dept. of physiology, Bangalore medical college and research institute.
- b. A detailed history was taken to rule out any medical/ surgical illness, medication use, and exposure to noise.
- c. Anthropometric variables were recorded:
  1. Height was measured by stadiometer without shoes.
  2. Weight was measured without shoes and with thin cloths on.
- d. Detailed clinical examination of ear, pinna, periauricular area, external auditory canal and tympanic membrane was carried out.
- e. Hearing acuity was tested by tuning fork tests.
- f. Pure tone audiometry done in a sound proof room as recommended by British Audiological Society.
  1. Air conduction thresholds were measured for each ear at 0.5, 1, 2, 4, 6, 8 kHz.
  2. Sensory neural hearing loss [SNHL] was defined as average pure-tone level greater than 25 dB for 0.5, 1, and 2 kHz (low frequency) and 4, 6, and 8 kHz (High frequency).

**STATISTICS:** Paired student t test was used to compare age, height, weight and hearing thresholds at various frequencies in both the ears.

**RESULTS:** Table 1 shows the anthropometric data of both control and test groups, the difference in body weight and BMI among both groups is statistically significant.

Table 2 shows average auditory thresholds for frequencies 0.5, 1, 2 (lower frequency), 4, 6 and 8 kHz (Higher frequency) of Right ear of control and test groups. Table 3 shows average auditory thresholds for frequencies 0.5, 1, 2 (lower frequency), 4, 6 and 8 kHz (Higher frequency) of Left ear of control and test groups. Mean hearing threshold for lower frequencies was significantly higher in the test group as compared to control group. Difference in hearing threshold for higher frequencies in both groups was not statistically significant.

	<b>Control group (Mean ± SD)</b>	<b>Test group (Mean ± SD)</b>	<b>P value</b>
Age	25.62±4.92	25.72±4.95	0.94
Height	1.66±0.08	1.62±0.087	0.06
Weight	63.03±6.18	76.76±9.6	< 0.001*
BMI	22.8±1.72	29.21±3.03	< 0.001*

Table 1: Age, height, weight and BMI of control and test groups

\*P value- highly statistically significant.

## ORIGINAL ARTICLE

	Control group (Mean ± SD)	Test group (Mean ± SD)	P value
500 Hz	22.4±5.11	30.34±4.8	< 0.001*
1000 Hz	21.9±5.25	29±6.03	< 0.001*
2000 Hz	19.48±5.6	25.7±4.38	< 0.001*
4000 Hz	19±4.09	23.1±5.73	0.0025*
6000 Hz	16.72±3.35	19.3±5.12	0.0268*
8000 Hz	13.27±3.84	14.5±4.7	0.289

**Table 2: Pure tone hearing level (dB) at each frequency, Right ear**

\*P value- highly statistically significant.

	Control group (Mean ± SD)	Test group (Mean ± SD)	P value
500 Hz	23.27±3.6	30.34±3.99	< 0.001*
1000 Hz	22.59±4.35	27.75±4.74	< 0.001*
2000 Hz	20.86±4.02	25.93±4.11	< 0.001*
4000 Hz	18.19±3.93	22.41±3.43	< 0.001*
6000 Hz	17.41±3.17	18.96±4.5	0.134
8000 Hz	14.31±2.9	14.13±4.02	0.852

**Table 3: Pure tone hearing level (dB) at each frequency, Left ear.**

\*P value- highly statistically significant.

**DISCUSSION:** In this study, we have found that higher BMI is associated with higher hearing thresholds particularly for lower frequencies. There is a mild degree (26-40dB) of hearing loss in test group for lower frequencies. The previous studies have examined multiple risk factors associated with sensorineural hearing loss; in this study we have examined the effect of only BMI (Independent risk factor) on hearing.

This cross sectional study confirms the previous studies findings of an association between higher BMI and sensorineural hearing loss.<sup>4,7</sup> Previous studies have examined multiple risk factors associated with SNHL, this study only focussed association of BMI and hearing loss, and we had a long list of medical and otological exclusion criteria, which were followed carefully not to include individuals with other risk factors affecting hearing.

Mechanism that may underlie the relation between high BMI and hearing function include hypoxia and ischemic damage, oxidative stress and formation of reactive oxygen species, and resultant death of cochlear and spiral ganglion cells that leads to hearing loss.<sup>3</sup> Obesity related atherosclerosis may lead to stiffening and constriction of the internal auditory artery and reduction in cochlear blood flow.<sup>8</sup> Reduced blood supply to cochlea, whether due to micro-vascular or macro-vascular compromise, can lead to capillary constriction within the stria vascularis, cell death, and poorer hearing sensitivity.<sup>7,9</sup>

## ORIGINAL ARTICLE

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In a study conducted by Anil K. Lalwani et al., it is observed that obesity in childhood is associated with higher hearing thresholds across all frequencies, particularly more in lower frequencies<sup>2</sup>. Another study conducted by Sameer Ahmed et al, demonstrated that obesity has a notable relationship with the presence and degree of hearing loss in adolescents, particularly in the high frequencies.<sup>10</sup> In our study we have demonstrated that higher BMI is associated with Low frequency hearing loss.

In individuals with higher BMI, acquired hearing loss, though mild can be progressive and in the presence of multiple risk factors like hypertension, cardiovascular diseases, type 2 diabetes, dyslipidaemia can lead to moderate to profound hearing loss. This affects quality of life, decreased productivity and in turn financial burden to the individuals. In spite of the importance of hearing in everyday life, mild hearing loss is often unnoticed and undertreated. Because higher BMI directly and indirectly (Type 2 DM, cardiovascular diseases, dyslipidaemia) affects hearing and is a modifiable risk factor, the present study intends to sensitize the society. Apparently, a healthy lifestyle and maintaining optimum BMI can be beneficial for hearing conservation not only in young adults, even in old age.<sup>11</sup>

**CONCLUSION:** This study demonstrates that young adults with a BMI of 25 or more are at increasing risk of mild sensorineural hearing loss.

**Limitations of the Study:** small sample size. The data collected is Cross-sectional hence casual inferences cannot be made.

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## ORIGINAL ARTICLE

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**FINANCIAL OR OTHER**
**COMPETING INTERESTS:** None

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Date of Submission: 28/03/2015.  
Date of Peer Review: 28/03/2015.  
Date of Acceptance: 30/03/2015.  
Date of Publishing: 08/04/2015.