

A Study of Relationship Between Serum Lipids and Sensorineural Hearing Loss

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Abstract

Sedentary lifestyle which is a very common thing nowadays results to cause new challenges on the normal physiological mechanisms of the human body. Passive living, Alcohol dependency, smoking habits, Nicotine dependency, Drug abuse may induce risk of developing certain diseases, particularly in elderly. To scrutinize the relationship between degree of sensorineural hearing loss and serum lipid level (total cholesterol, triglyceride, low density lipoproteins, high density lipoproteins).A cross-sectional study was conducted in 70 patients aged between 30 to 60 years diagnosed with sensorineural hearing loss at ENT outpatient department in SGT Hospital, Budhera, Gurugram, India. All the 70 patients were amongst age group of 30 to 60 years who were registered from June 2022 to June 2023. Elevated serum levels of total cholesterol in males and females, along with triglyceride levels in males, are significantly correlated with the severity of sensorineural hearing loss. Conversely, there is no observed direct correlation with high-density lipoprotein and low-density lipoprotein levels for both genders. The presence of a hyperlipidemia state constitutes a major menace for individuals suffering from sensorineural hearing loss (SNHL). Regular screening and systematic monitoring of serum lipid levels could prevent the progression of severe SNHL, leading to an enduring enhancement in the quality of life for patients

Keywords SNHL · Quality of life · Lipids · Hyperlipidemia · Total cholesterol · LDL · Triglyceride · HDL

Introduction

Sedentary lifestyle which is a very common thing nowadays results to cause new challenges on the normal physiological mechanisms of the human body. The detrimental effect of the inactive lifestyle, excess body weight, and high saturated fat rich diet overlay on a genetic background grants susceptibility to Elevated circulating lipids. Nutritional choices and daily active habits are major factors thought to influence vulnerability to various illness. Passive living, Alcohol dependency, smoking habits, Nicotine dependency, Drug abuse may induce risk of developing certain diseases probably in the long run. Numerous studies have illustrated a link between hyperlipidemia and hearing disorders, but this point remains Contradictory. According to study conducted by Suzuki K et al. [1] it was observed that auditory capacity amongst the group at 2000 and 4000 Hz for group with elevated HDL cholesterol were substantially better than those in the decreased HDL cholesterol group in men.

Sharma R et al. [2] in their study the male-to-female ratio was determined to be 1.125:1. Additionally, there was a significant association found between serum total cholesterol and serum triglyceride levels with the degree of hearing loss (p value < 0.001). Conversely, serum HDL levels exhibited a statistically insignificant and negative correlation with the severity of hearing loss. The serum lipid profile emerges as a crucial biomarker for gauging the extent of hearing loss. Individuals with disturbed lipid parameters displayed more pronounced degrees of hearing impairment. Contemporary sedentary practices, accompanied by a prevalent preference for diets rich in saturated fats, obesity, and an evident genetic predisposition, heighten the likelihood of elevated circulating serum lipid levels. The mentioned factors, namely sensorineural hearing loss and hyperlipidemia, have been linked and researched in the past, but their precise connection is still a subject of discussion.

Methods

A cross-sectional study was conducted in 70 patients aged between 30 to 60 years diagnosed with sensorineural hearing loss at ENT outpatient department in SGT Hospital, Budhera, Gurugram, India. All the 70 patients were amongst age group of 30 to 60 years who were registered from June 2022 to June 2023. Subjects were assessed for sensorineural hearing loss. Only those instances were documented, where complete consent for the protocol was granted. Patients attending ENT outpatient department with sensorineural hearing impairment confirmed by pure tone audiometry aged 30–60 years. All participants without any significant systemic illness or sudden infection with intact tympanic membrane on both sides, and no history of ear, nose, throat surgery were enrolled in our research. Patients with any middle ear disorders, high blood pressure, vasculitis, and abnormal thyroid function are not included in our research. All instances underwent thorough scrutiny which comprised overall physical examination, meticulous inspection of ear, nose, and throat. Otoscopic examination and pure tone audiometry was performed. The patients were assessed for hearing loss based on the WHO (2008)

categorization. Patients diagnosed with sensorineural hearing loss were assessed for fasting lipid levels. Serum lipid analysis was performed in our hospital laboratory. This involved evaluation of total cholesterol, triglycerides, HDL, LDL, VLDL. The measurement was conducted using a completely automated analyzer ERBA-XL (EM-200). Data were collected, stored, and processed using SPSS statistical software.

Results

The results were recorded and examined. In this study, the following observations were noted: Individuals with mild hearing loss (57) accounted for 38%, those with moderate hearing loss (73) represented 48.67%, individuals with severe hearing loss (12) constituted 8%, and those with profound hearing loss accounted for (8) 5.33%. 62% of the patients were male, and 38% were female. In both genders, the majority of patients exhibited a moderate degree of hearing loss; specifically, males (29%) and females (19%). In the current study, the average total cholesterol level was determined to be 230.52 ± 10.06 mg/dl. Statistical evaluations were performed using the ANOVA test. The P value was 0.037, which, as it is less than 0.001, was considered highly statistically significant.

In this study, the average total triglyceride level was determined to be 287.28 ± 50.63 mg/dl. Statistical analysis was conducted using the ANOVA test. The P value was 0.0019, which, being less than 0.001, was considered highly statistically significant.

In the current investigation, the average level of high-density cholesterol was determined to be 48.26 ± 2.95 mg/dl. Statistical analyses were conducted using the ANOVA test. The P value was 0.054, which, being less than 0.001, was considered highly statistically significant.

In the present research, the average level of low-density lipoprotein was determined to be 124.96 ± 9.88 mg/dl. The mean values of LDL levels among different hearing groups were statistically analyzed using the ANOVA test. The p-value was found to be 0.0025, which, being less than 0.001, was considered highly statistically significant.

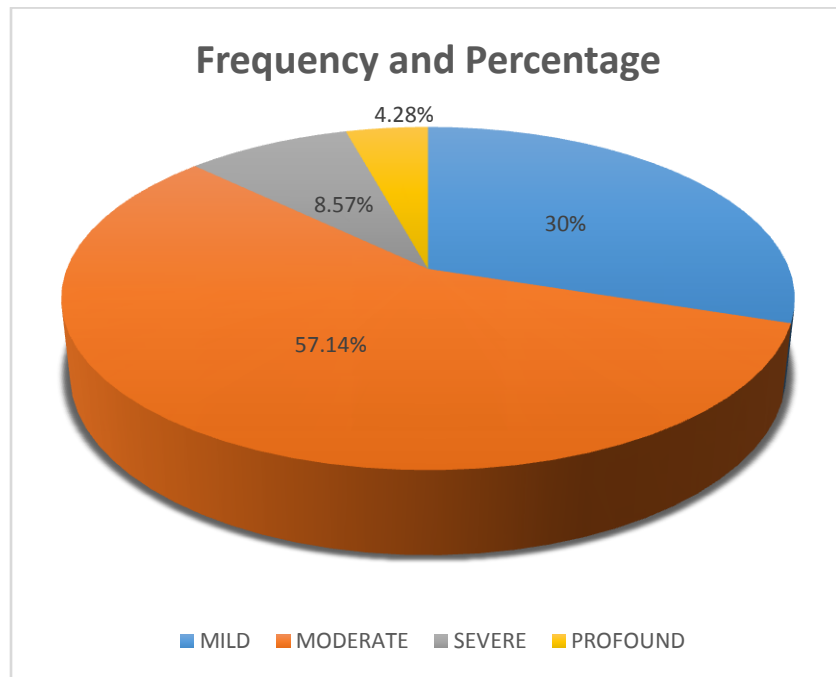


Fig. 1 Distribution of subjects according to level of SNHL

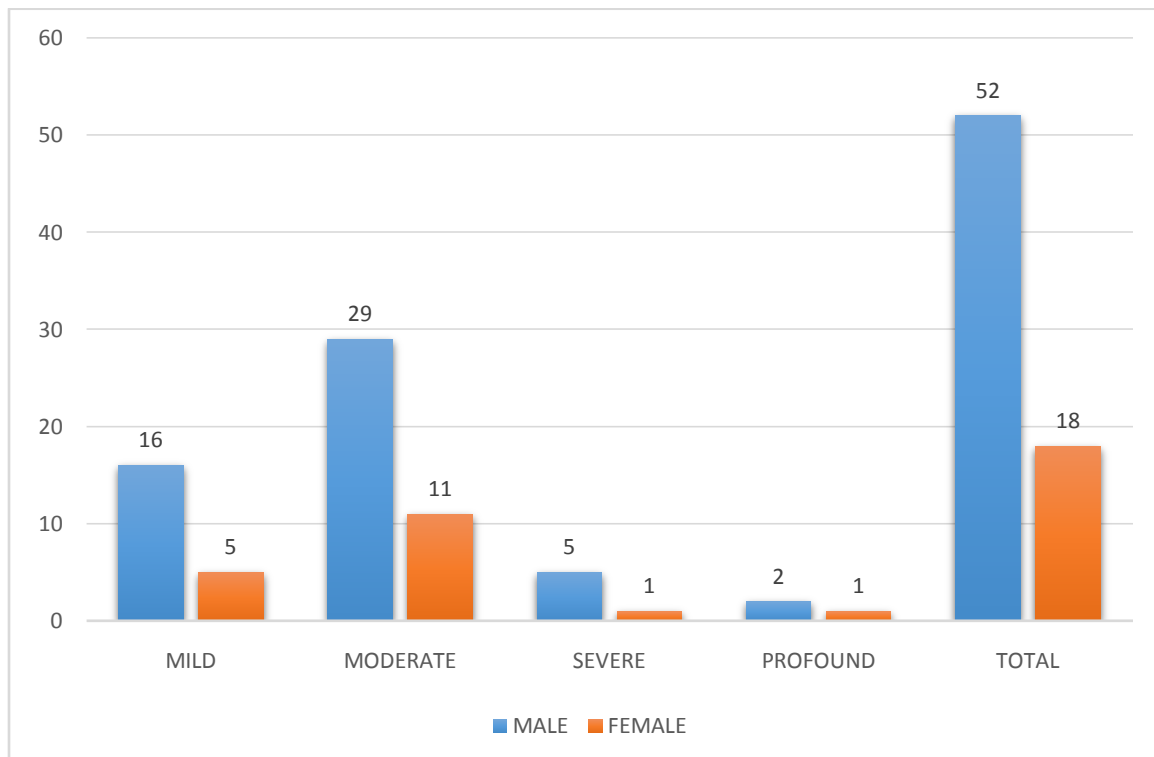


Fig. 2 Distribution of subjects according to gender and level of SNHL

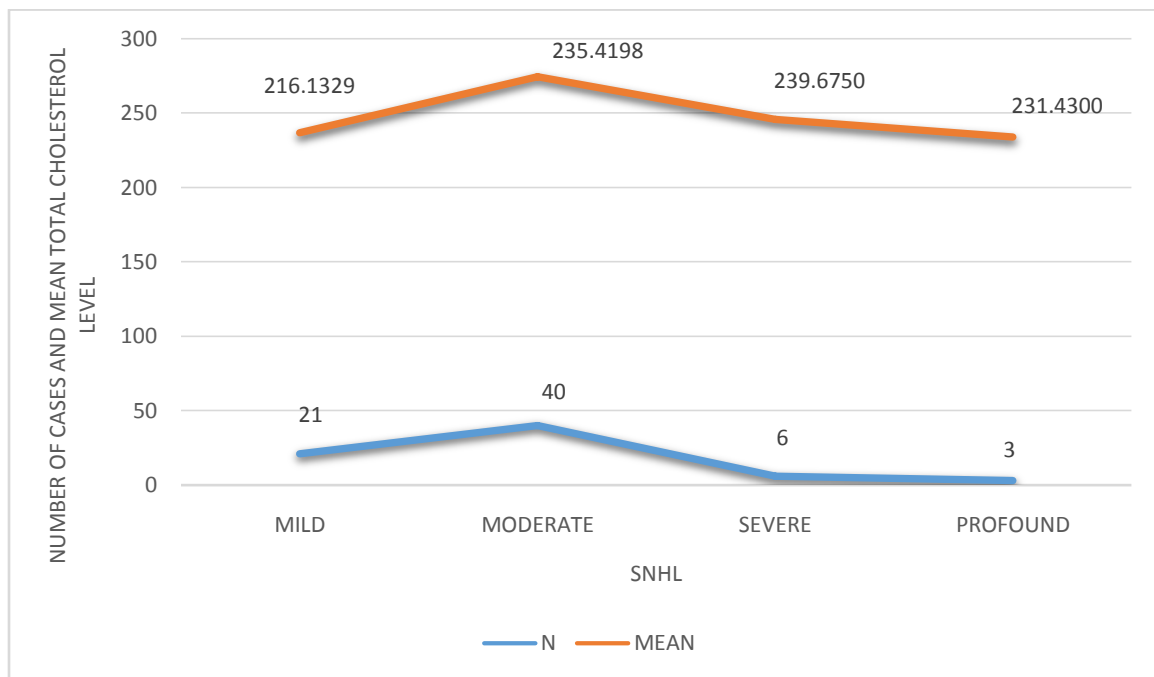


Fig. 3 Mean cholesterol levels according to level of SNHL. *p value=<0.001 which is highly statistically significant

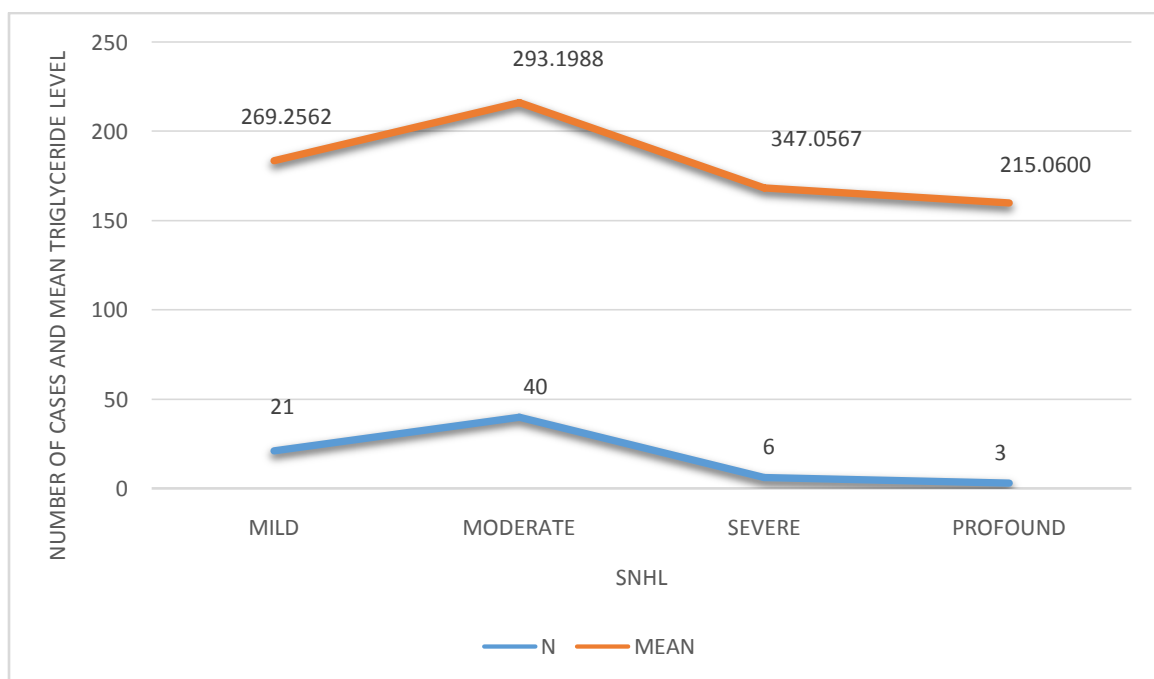


Fig. 4 Mean triglyceride levels according to level of SNHL. * p value=<0.001 which is highly statistically significant.

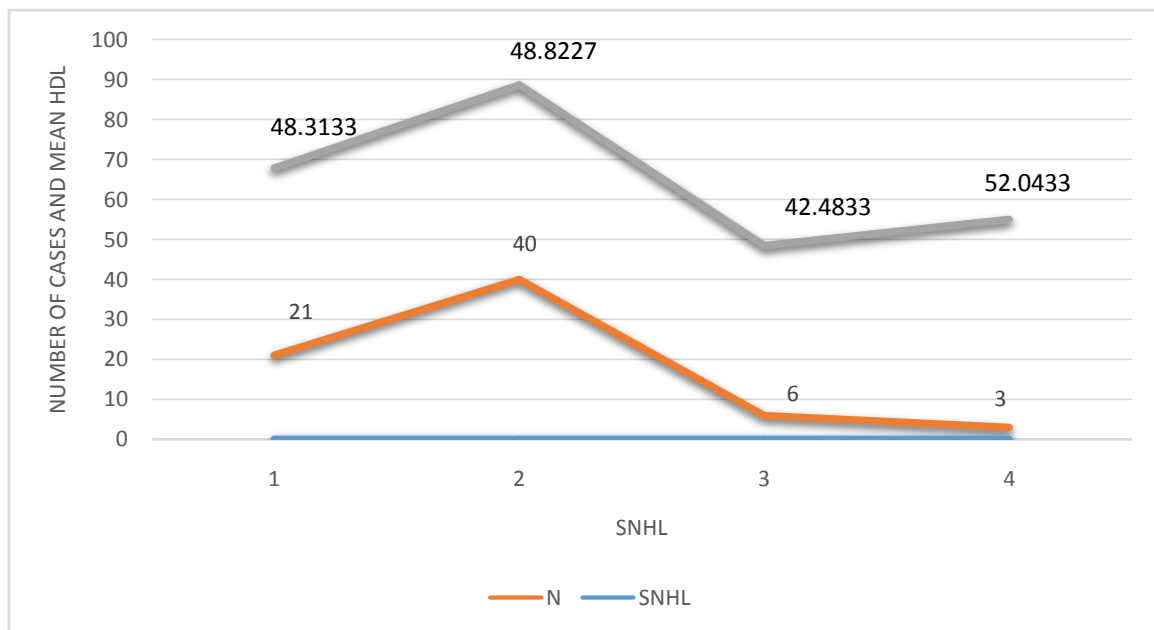


Fig. 5 Mean HDL levels according to level of SNHL. * p value=<0.001 which is highly statistically significant

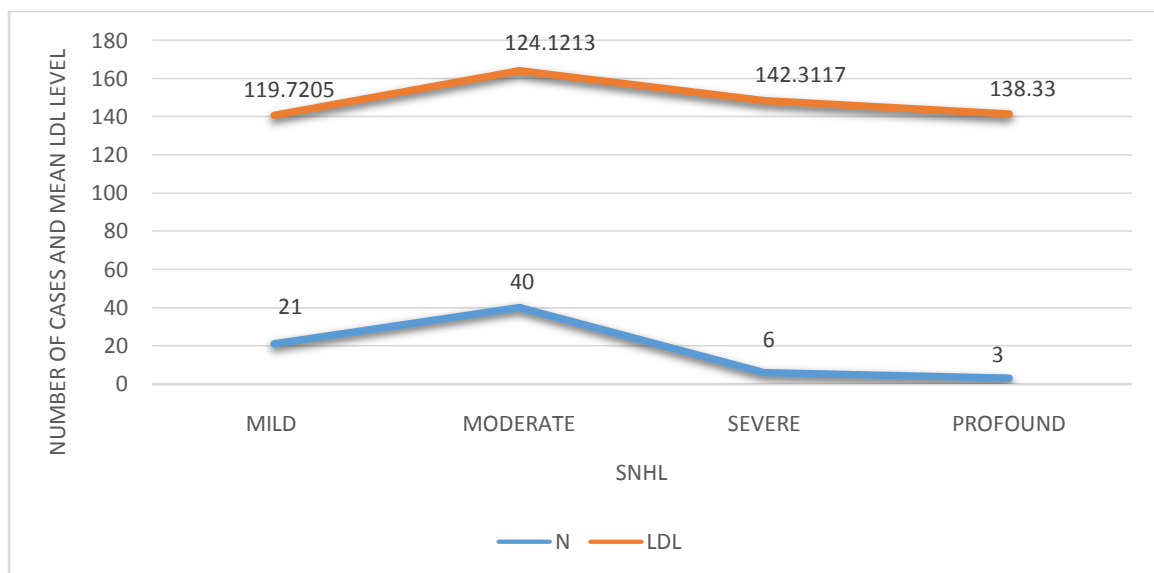


Fig. 6 Mean LDL levels according to SNHL. * p value=<0.001 which is highly statistically significant

Discussion

Microscopic alterations in the cochlea caused by hyperlipidemia [3]. The function of the inner ear is affected by ischemia, given that the blood circulation to the inner ear relies on the end

arterioles. The cochlea, which receives its blood supply from an end artery, is regarded as extremely vulnerable to pathological changes in blood vessels and it is regarded as extremely vulnerable to pathological changes in blood vessels. It is widely recognized that increased levels of cholesterol lead to atherosclerotic modifications in the walls of blood vessels, resulting in partial blockage of blood flow and insufficient oxygen supply to the affected organ. It has been suggested that these atherosclerotic alterations in cochlear vessels might result in hearing impairment.

Oxidized low-density lipoprotein (LDL) is thought to have a significant impact on the occurrences related to the beginning of atherosclerosis. Any ailment that influences blood consistency or the physical properties of red blood cells is expected to modify the efficiency of oxygen and nutrient distribution to the stria vascularis tissue. Inner ear tissues with heightened metabolic needs may exhibit altered metabolic processes when hypercholesterolemia is present, due to reduced oxygen availability. Intercellular swelling in the stria vascularis layer and intracellular swelling in the outer hair cells observed might be the explanation for auditory dysfunction. The presence of edema in the stria vascularis was very likely triggered by modifications in the vessel wall and deteriorating blood flow, similar to the arteriosclerosis observed in the coronary arteries. In present study conducted on 70 patients, the number of males is 44 and the number of females is 26. The ratio of male: female for SNHL comes out to be 1.69:1. Examining the cohort in the study on blood chemistry levels and hearing levels, Lee FS et al. [4] found that there were 128 male patients and 89 female patients. The ratio of 1.44:1 highlights the higher representation of males in comparison to females. Suzuki K et al. [1] investigated 607 male patients and 317 female patients to assess the impact of serum lipids on auditory function. The male-to-female ratio was determined to be 1.91:1. The results from the referenced studies consistently lean toward the notion that the disease has a greater likelihood of occurring in males. Our study shares common ground with the referenced research, indicating a likelihood of the disease being more prevalent among males. Our findings indicate that individuals aged 41–50 years experienced the most prevalent moderate degree of hearing loss. According to findings from Wysokinski A [5], involving 4,541 participants, the odds of hearing loss were found to increase with age. The odds ratio for a 5-year interval was 1.88, with a 95% confidence interval ranging from 1.80 to 2.97. The incidence of hearing loss is twice as high in individuals with diabetes as in those without diabetes, and those with prediabetes exhibit a 30% higher likelihood of experiencing hearing issues

The mean level of total cholesterol was found to be 240.87 mg/dl. The level in males was found to be 232.73 mg/dl and in females it was 224.91 mg/dl in this study. Females with higher cholesterol levels exhibited a significant positive correlation with increased hearing loss ($r = 0.790$, $p < 0.01$, two-tailed), indicating a strong association. Similarly, the correlation analysis in males also revealed a statistically significant positive relationship between the degree of hearing loss and cholesterol levels ($r = 0.532$, $p < 0.01$, two-tailed), suggesting that as cholesterol levels

increase, there is a corresponding increase in the degree of sensory neural hearing loss. These findings underscore the impact of cholesterol on hearing health, with both male and female populations showing significant associations between elevated cholesterol levels and increased susceptibility to sensory neural hearing loss. As per the investigation led by Sharma et al. [2] the levels of serum total cholesterol and serum triglyceride exhibited a substantial association with the extent of hearing loss (p -value < 0.001). The escalation in serum LDL demonstrated a concurrent rise in the severity of hearing loss, and this correlation was statistically significant (p -value < 0.001). Conversely, the serum HDL level indicated a statistically insignificant and negative correlation with the severity of hearing loss

The mean level of total triglyceride was found to be 287.28 mg/dl. The level in males was found to be 300.77 mg / dl and in females it was 264.45 mg/dl. The correlation between the degree of sensorineural hearing loss and triglyceride in Males is positively associated, with a correlation coefficient of 0.327. Since the p -value is 0.030 (less than 0.05), this correlation is considered statistically significant at the 0.05 level and for Females, the correlation between the degree of sensorineural hearing loss and Triglyceride is also positive, but the correlation coefficient is smaller at 0.200. However, the p -value (0.327) is greater than 0.05, indicating that this correlation is not statistically significant at the 0.05 level.

Anil and Shazia [6], conducted a study on 100 adults between 30 and 60 years' old who had sensorineural hearing loss (SNHL), revealing a significant link between serum lipid levels and the different degrees of hearing impairment. Lee FS et al. [4], investigated various blood chemistry parameters and serum lipid profiles in a cohort of 217 patients with different hearing levels, ranging from normal to moderate/severe. The average triglyceride levels were found to be 52.8 ± 12.88 mg/dl. Marco Matteo Ciccone et al. [7] examined 29 patients with idiopathic sudden sensorineural hearing loss, revealing a triglyceride level of 109 mg/dl, with no statistically significant findings. In the studies conducted by Friedrich et al. [8] and Gates et al. [9], there was no discernible correlation found between sensorineural hearing loss (SNHL), Serum Triglyceride, and Serum Total Cholesterol

In present study the mean level for low density lipoprotein was found to be 124.96 mg/dl. In males the level was found to be 128.96 mg /dl and in females 119.50 mg/dl. There is no statistically significant association between the level of LDL and the degree of sensorineural hearing loss in females. Our Study show no statistically significant association between the level of LDL and the degree of sensorineural hearing loss in males ($p=0.434$) and female ($p=0.408$). A research endeavor undertaken by Jalisatgi [10] in 2009 in Bijapur, India, involving 64 patients with sensorineural hearing loss (SNHL), revealed a direct correlation between the severity of SNHL and serum levels of LDL, with a simultaneous negative correlation observed between HDL levels and the severity of sensorineural hearing loss

In our study the mean level of high-density cholesterol was found to be 48.26 mg/dl. In males the level was found to be 47.65 mg/dl and in females 49.29 mg/dl no significant association was seen between high density lipoprotein and degree of sensorineural hearing loss both in males with $p=0.056$ and females $p=0.273$.

Conclusion

Elevated serum levels of total cholesterol in males and females, along with triglyceride levels in males, are significantly correlated with the severity of sensorineural hearing loss. Conversely, there is no observed direct correlation with high-density lipoprotein and low-density lipoprotein levels for both genders. A hyperlipidemic state poses a significant risk for sensorineural hearing loss (SNHL). Consistent screening and surveillance of serum lipid levels have the potential to avert severe SNHL and enhance the long-term quality of life for patients

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