AUDIOLOGICAL FINDINGS FOR THE INMATES OF OLD AGE HOME

REGISTER NO.M8904

THE INDEPENDENT PROJECT IN PART FULFILMENT FOR THE DEGREE OF MASTER OF SCIENCE (SPEECH AND HEARING), UNIVERSITY OF MYSORE

ALL INDIA INSTITUTE OF SPEECH AND HEARING: MYSORE - 570 006

MAY,1990

PARENTS

BROTHER

SISTERS

SISTER-IN-LAW

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CERTIFICATE

This is to certify that the Independent Project entitled: **AUDIOLOGICAL FINDINGS FOR THE INMATES OF OLD AGE HOME** is the bona-fide work in part fulfilment for M.sc., in Speech and Hearing, of the student with Register Number M8904.

Mysore
May,1990

Director
All India Institute
of Speech & Hearing
Mysore - 570 006.

CERTIFICATE

This is to certify that the Independent Project entitled: **AUDIOLOGICAL FINDINGS FOR THE INMATES OF OLD AGE HOME** has been prepared under my supervision and guidance.

Dr.(Miss) S.Nikam,
GUIDE.

DECLARATION

This Independent Project entitled: AUDIOLOGICAL FINDINGS FOR THE INMATES OF OLD AGE HOME is the result of my own study undertaken under the guidance of Dr.(Miss) S.Nikam, Professor and Head of the Department of Audiology, All India Institute of Speech and Hearing, Mysore, and has not been submitted earlier at any University for any other Diploma or Degree.

Mysore

May, 1990 Register No.M8904

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INTRODUCTION

Communication is the sending and receiving of message both verbal and nonverbal within between and among people (Oyer and Oyer, 1976). It is a social glue that binds people together, that co-ordinate their activities and make organized social life possible (Woolfel, 1976). Any defect in the communication system jeopardizes the survival of the individual as well as the society.

Society ia comprised of member of all ages. The contribution of each group ia important for the societies well being. Each age group has a specific role to play into the society. To effectively execute their roles the intra and inter personal communication among the members of the society is of prime importance.

The geriatric population, which is once of the major section of the society has been found to bo contributing significantly to the bettement of the society. They are a windows to the past which aids in the maintenance of culture in the society.

The well being of the older popple will be of stake, due to several change in social, psychological and biological process that occurs concominantly with age. One of these type of social trauma experienced as age advances is the retirement from age. This affect the mental well being at the individual. Added to this biological change occur in several body system.

One of the most common problem is a breakdown in the communication system in the older people. The impairment of communication is brought about mainly by the change in the sensory perceptual and speech mechanism.

With increase is age, the hearing sensitivity deteriorates, resulting characteristically in a high frequency loss. This condition was termed as prosbycusis by Zawaardemaker (1899). But presbycusis as understood now does not limit to only pure tone loss. The geriatric populations showing presbycusis most often complain of an inability to understand the speech of others which ia incompatible with their average loss in pure tone sensitivity. This phenomena is termed as phonemic regression.

Stadies in the geriatric population have bean carried out in different races such as negroid and concasian. The cultural and environmental influence on presbycusis has been brought forth in the studies conducted on some of the primative tribes (Rosen et al. 1970). So all this point out, need to have specific presbycusis data.

The present study was designal to provide auch data for inmates of old age home by studying variation in hearing aa a function of age and sex.

Need for the study:

The study of the present nature is important for the following reason.

Thare is a drastic decrese in death-rate due to the advancement of medical science. Indian census 1981, revealed that there ia a decrease in death rate about 20 percent daring the last 70 years, so the problem encountered by the aged haa become of central interest in social and medical field.

With increasing social as well as economic pressure, some of the senior citizen are forced to stay in old age homes and more than half of the aged population are hearing impaired. Medical and surgical services are of limited value to old age population in presbycusis. The rehabilitation program centres around and accurate assessment of handicap. Without prior assessment it ia not possible to rehabilitate the individual.

Very few studies have been carried out in India on inmate of old age home and finding of these studies have limited application.

The present study is intended to provide information regarding different aspects of hearing of the inmate of old age home.

The present study was aimed at answering the following questions:

1) Is there any progressive deterioration in hearing acuity with age?
2) Is there any difference in the hearing acuity for men and women?
3) Is tone decay differentiate retrocochlear pathology in presbycusis.

The term presbycusis means deafness due to aging which is the auditory manifestation of biological process involving all the tissues of the body. The catabolic processes involved in senility can affect the Middle ear, cochlear. cochlear nucleus, central auditory nervous system. It usually commance in the middle age and is progressive, symmetrical and sensory neural in nature.

Gross audiological attribute to the presbycusis has been recognized since 1899 after Zwaardemaker had coined the term to donate poor hearing of elderly people.

The incidence of hearing loss in the elderly population ia significantly high and most common cause of hearing loss in presbycusis, or loss of hearing due to aging process (Sataloff, 1966).

Bunch and Raidford (1931) reported hearing level of both male and female of a combined negro and white population in United Stats of America. At 50 years of age the white male has the poorest hearing level at 8000 Hz and negro male the best. However Dadson and King (1952) reported no significant difference in age group of 18-25 years between hearing of male and female.

Glorig (1954) published data from Wiscosin state fair hearing survey on men and women upto 79 years of age. They concluded as follows:

1. Hearing loss for subjects in their total sample became greater with increasing ago.
2. Onset of hearing loss was more gradual among women than among man except in later years when reverse came true.
3. With each 10 years increase in age for male, the median hearing loss at 6 KHz increased approximately 10 dB as compared with only 3 dB at 1 KHZ.

Corso (1963) had reported that in male preabycusis started from 26 to 32 years and in female it ia from 37 years. Onset is gradual in female but rate of progress ia greater in female. Female shows better hearing in high frequency and the males showed better hearing in law frequency. In both groups, the right ear sensitivity was better than that in the left ear.

American Speech and Hearing Association (ASHA) report on 1971 indicate that over 24 million elderly citizen have significant bilateral impairment. This report projects more than 3 million aged with bilateral hearing impairment. According to Chaffe (1967) 90 percent of the persons living in senior citizen environment have hearing impairment. Senate committee of aging (1968) has suggested that hearing loss restricts 30-50 percent of population over 65 years.

Plomp (1978) reported that 24 percent of the populations are having handicapped at the age of 65 years, 30 percent at the age of 70 years and 50 percent by the age of 75 years.

A review by Marshal (1981) showed that the aging process affect hearing sensitivity and following are the excerpts from the article.

The incidence of hearing loss in the elderly population is significantly high and the most common cause of hearing loss. It usually commence in the middle age and is progressive symmetrical end sensory neural in nature.

Indrani (1981) has reported that onset of presbycusis was in 5th decates Hearing problem increased with age, hearing was better in female than in males for frequencies above 1000 Hz, but poorer in females than in males for 250 Hz, change in hearing acuity waa more in female, there was no significant difference with age.

Prevalence of hearing loss as a function of age (1976)

Age period (years)	**Rate/1000 person**
All ages	71.6
Less than 17	13.0
17-44	42.4
45-64	114.1
65-74	231.1
More than 75	398.6

Originally presbycusis was felt to manifest change primarily to cochlea, but more recent thinking has suggested that entire auditory system undergoes a variety of significant changes (Schuknecht, 1935).

Rosen et al. (1962) suggested that presbycusis changes are related to genetic faster fascular reaction, difference in metabolism and nutrition. Increase in stress and environmental noise associated with modem civilization play a role in the age related change in hearing sensitivity.

Physiological alteration in the auditory system of presbycusis ear can bo studied under the major division of hearing mechanism.

1. External ear:

Alternation in pinna and external auditory meatus has been reported in literature.

Increase in the size of pinna has been reported by many inveatigators (Guild, 1942, Tsai et al. 1958, Chon and Chang, 1958,Williford, 1971). Average increase is the length of the pinna has been observed to manifest sex differences. In male, the increase reported was 5.13 mm in length and 2.28 mm in width, whereas in females, the increase has been reported to be 3.69 mm is length and 2.26 mm in width as ago advanced from 20 to 50 years (Tsai et al. 1958).

Increase in tho length and width of pinna ia because of gradual loss of skin plasticity, muscle tonocity, longi-tudinal force of gravity etc. (Glorig, 1973) Fowlor, 1972).

Senturia (1957) roportod excessive freckling of the pinna.

A number of changes such as widening of the canal has been reported by Fowler, 1940; Show et al. 1978. Thinning of skin linning, the canal and a diminished elasticity (Senturia 1957; Rosenwasser, 1964) and a pronounced dryness of epidermis of the canal (Senturia, 1957) has been roported. The cartilagenous portion of the Eaternal auditory mestus loses its elasticity resulting in partial (or rarely complete) occlusion of the canal (Magladery, 1959) impede the natural path of air conducted sound more as in high frequency region.

Loss of feeling, reduced perceptual awareness for tactile sensation, generally accompanies senescense (Butter and Lewis, 1973). Temporal modulation of tactile senesation through low frequency vibration has revealed marked elevated vibration threshold.

External ear structure also has certain important function. The pinna for example contributes to auditory perception.

Menser (1879) reported pinna aids in the collection of sound wave. Mach (1875) claimed pinna to be a reasonator for high frequency sounds thereby affecting the timbre of the stimulus. The role of the pinna in auditory perception has been demonstrated by two hypothesis.

1. Pinna shadow hypothesis (Mills, 1972) which assumed that pinna function to shadow the high frequency energy for sound coming from the ear to provide monoaural loudness information.
2. Pinna reflection hypethesis (Buttean 1968) which assume that pinna perform a monoaural time delay of the incoming wavefront and that the pattern of these delay uniquely specifies the direction. He conducted many experiment and baaed on the result obtained he claimed that pinna

evidently transform the sound entering the ear canal in a way that indicate source direction and distance.

Research on the effects of hearing protector on localization have confirmed the importance of pinna in localization (Hochberg, 1962; Nobel and Russel, 1972).

As in the geriatric population the pinna and other external ear structure undergo changes, their localization ability might be affected.

2. Middle ear:

In early 1960's Olorig, Devis and Rosen demonatrated conductive hearing loss in older people, who had not exposed to any significant noise i.e. middle ear conductive preabycusis. But it is also generally accepted that middle ear despite its arthritic joint change, does not contributs to hearing loss in the aged.

Cornell (1952) reported that tympanic membrane was thin translucent and loses it's rigidity. So, the adjacent ossicular marks are more visible as it is thin.

In the ossicles, changes such as, increase in the regidity of ossicular chain, ossification of malleoindudal joint, calcification of articular cartilage and atrophy of ossicular chain specifically inthe crura of the stapes has been reported

(Rosenwasser, 1963). Klotz and Crabbe (1963) have attributed the regidity to the sclerosis of the joint. Farriors (1963) study supported Klotz and Crabbe (1963). He found that older people were also susceptible to otosclerosis as in one third of the 125 agad subject studied had otosclerosis.

Degeneration and atrophy and tensor tympani and atrophy of tha ligaments attached to ossicles has been observed (Connel, 1952; Rosenwasser, 1964; Davis, 1970). This alteration reduces operating efficiency of middle ear system, thereby affecting the hearing acuity.

Nerbonne, Schow, Goset and Bliss (1976) have reported of abnormal negative pressure in the middle ear of the aged person. This has been attributed to atrophy of levator and tensor palatine resulting in reduced patency in eustachian tube.

Evidence for the involvement of middle ear was given by Glorig and Davis (1961). They observed an air-bone gap which increased with age and frequency in the older subjects of the sample ranging in age from 25 to 80 years. This type of pattern in the elderly was termed as conductive presbycusis by them. But the above finding was questioned by Staloff, Vassalo and Menduke (1965), as they failed to observe any air-bone gap in subject aged 62 years to 86 years. Thus, though middle ear involvement was confirmed, their effect on hearing acuity was not established. The prevailing belief is that presbycusis is a sensory neural type of hearing loss.

3. Inner ear:

Numerous studies has been documented the histopathological finding in temporale bone of aged (Saxon and Von Fienelf, 1937; Jorgenson, 1961; Suchuknecht, 1957).

The most important alteration in the inner ear with aging has been hair cell degeneration (Crowe, Guild, Polvoget, 1934 Schuknecht, 1955y; Pestalozza and Shore, 1955; Gacek, 1975). The degeneration has been attributed to the decrease in the enzymatic activity of the lysosomes in the hair sell.

The other changes which has been observed in the inner ear with aging are an increase in the stiffness of the basilar membrane (Mayer, 1920; Crowe et al. 1934; Schuknecht, 1967) atrophy, rupture with thinning of membrane at the site of rupture.

One other important structural alteration observed is, the atrophy of stria vascularis (Crowe et al 1934) Ven Fiendt, 1937; Schuknecht, 1964). Atrophy of stria vascularis has been considered one of the major factor in the hairing impairment of the elderly.

Hinchcliffe (1962) has summarized the alteration of the inner ear as follows:

a) Atrophy and degeneration of both hair cells and supporting cells of the cochlea.

b) Angiosclerotic degeneration of epithelial tissues and vessels of inner ear, including organ of corti, basilar membrane and stria vascularis.

c) Thinning and adhesion of tectorial membrane.

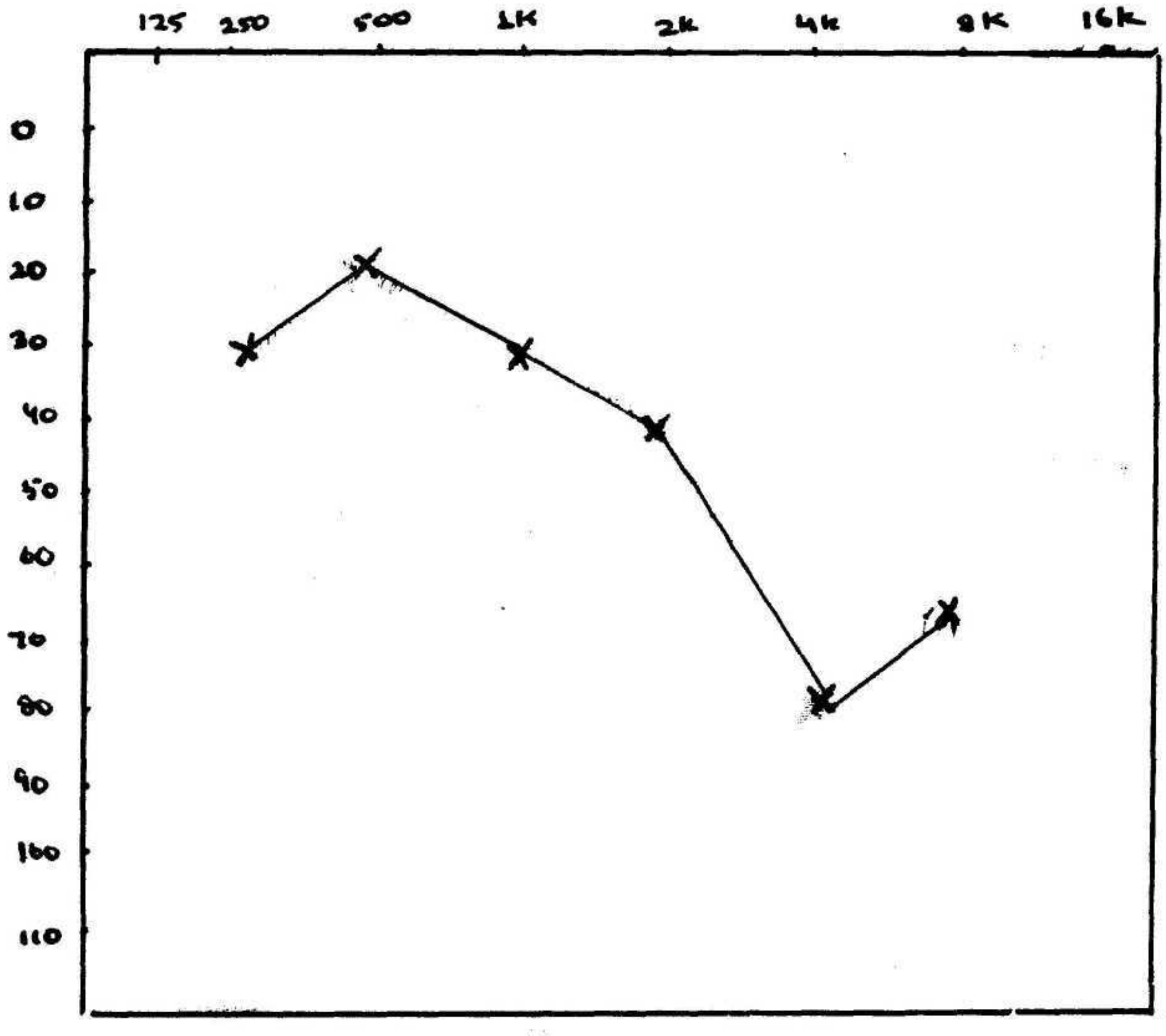
d) Reduced nutritional content of endolymph.

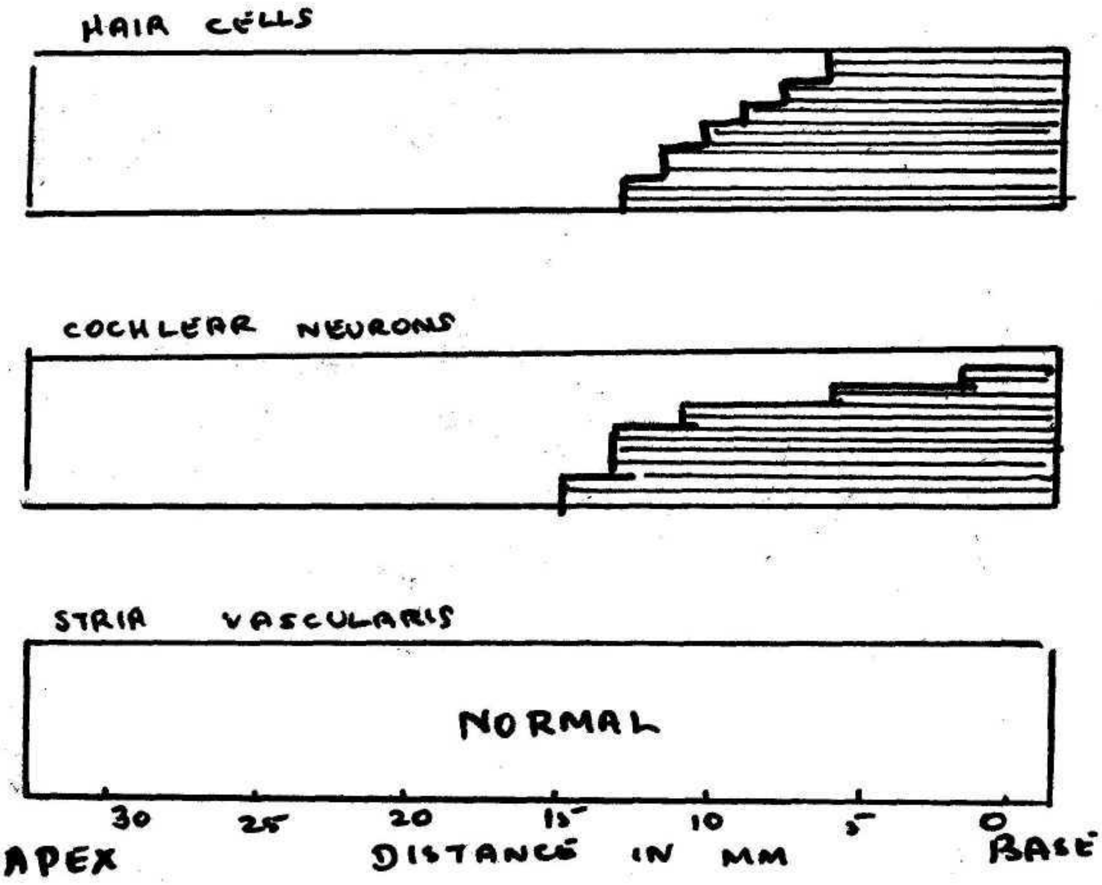
e) Calcification and loss of elasticity of basilar membrane.

On the baaia of histopathological finding Crowel et al and Saxen (1937) describe two pathological types of deafness. One mainly involved the organ of corti (termed sensory preaby-cusis by Schuknecht, whereas the other primarily involved the cochlear neuron termed as neural presbycusis. In 1964, Schuknecht described two additional categories one involving the stria vascularis and termed metabolic presbycusis and other thought to be caused by stiffening of basilar membrane which changed motion mechanics of inner ear (inner ear conduc-tive deafness).

Sensory Presbycusis:

Sensory presbycusis is morphologically characterized by atrophy of the organ of corti in the basal end of cochlea. It usually begina in middle age and is manifested by an abrupt high tone hearing loss. The condition is very slowly progressive and often does not include middle and apical turns of cochlea, thus sparing the speech frequencies. Initially there is flattening of organ of corti followed by 1Oose of supporting cell and subsequent secondary neural degeneration due to loss of supporting cell.

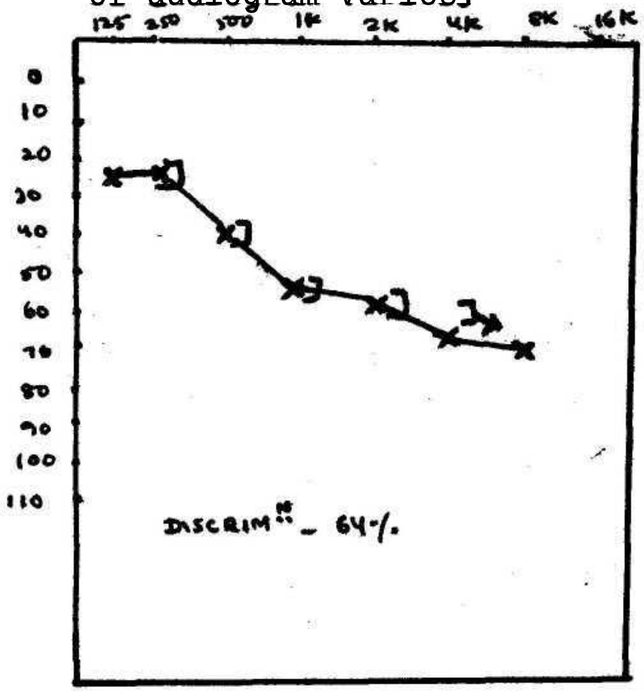


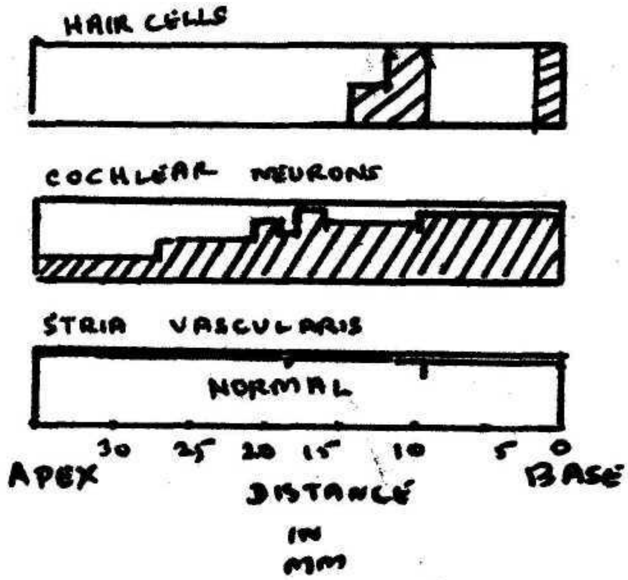


Audiogram sloping bilateral symmetric loss of sensory neural type (Starts from 2-3 KHz), abrupt high tone loss. No recovery in high frequency threshold as in noise induced loss. Recruitment may be present. Discrimination loss may be due to decreased sensitivity of impaired frequency selectivity.

Neural Presbycusis:

It is due to loss of cochlear neuron usually mere severe in basal turn, frequently involving entire cochlea. This may begin at any age. Critical number of neural aliment are important for discrimination. The relatively unaffected organ of corti accounts for better pure tone hearing, for speech understanding critical number of functioning neuron is essential. This is more likely to be genetically determined if early in onset and presbycusis if later onset in life. Audiogram shows bilateral symestrical descending threshold with reduced discrimination which relatively more than pure tone threshold. Severe in high frequency slope of the curve of audiogram varies.

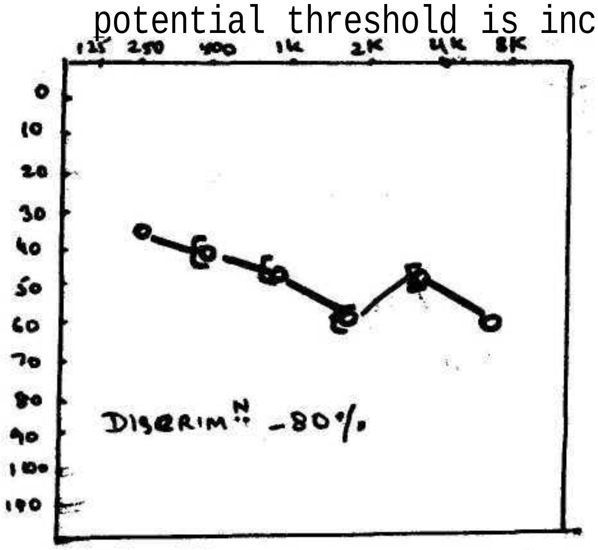


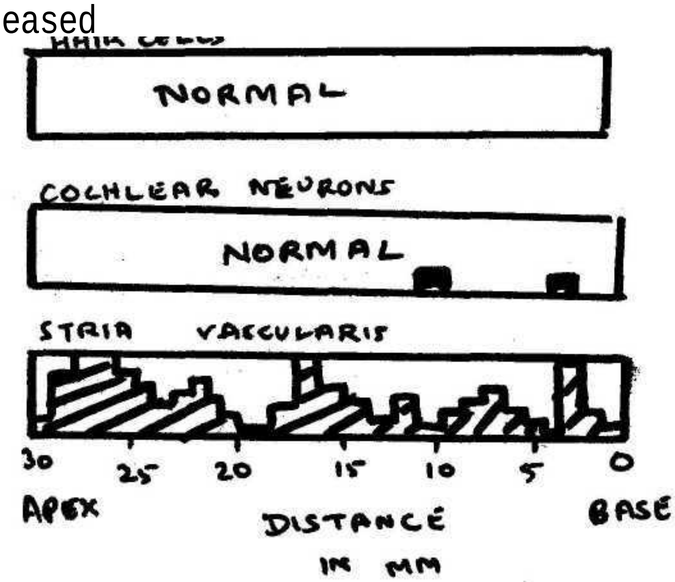


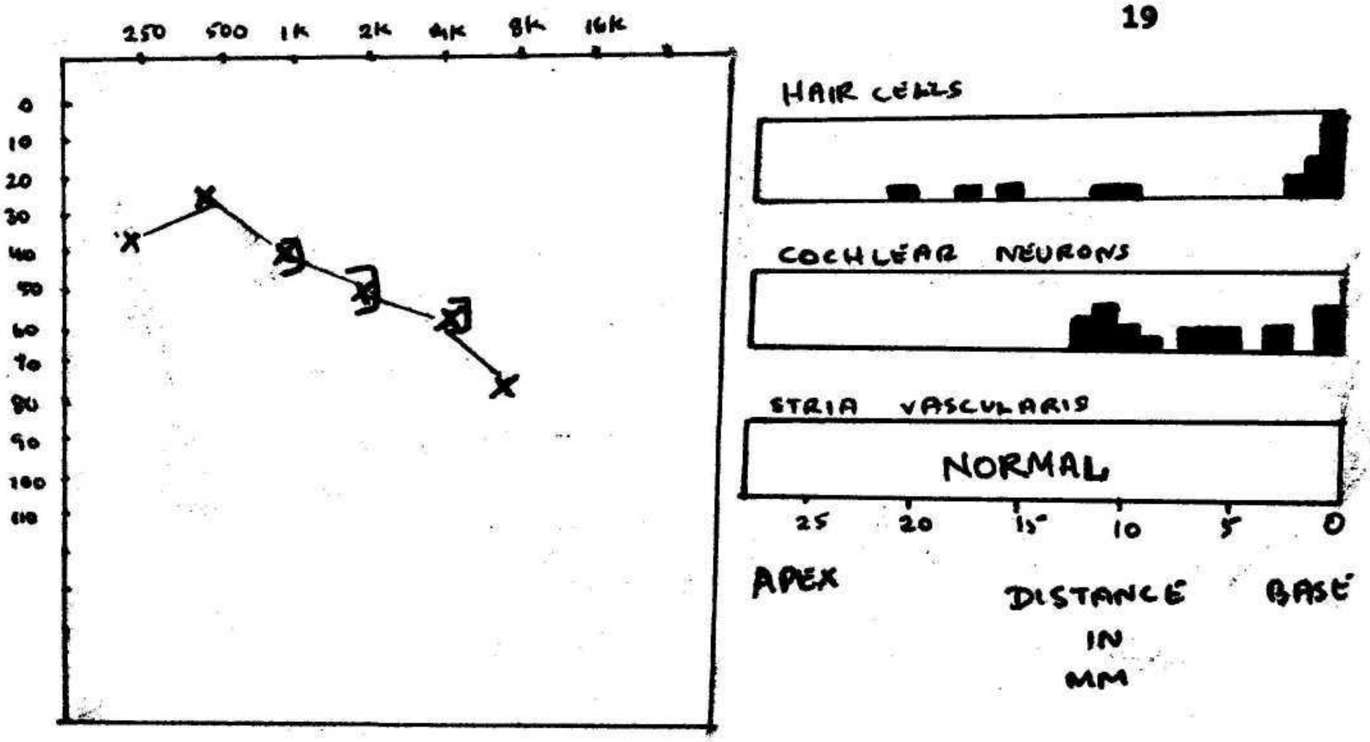
Strial or vascular presbycusis:

Hereditory plays an important role onset is generally 3rd to 6th decade. Atrophy of stria vascularis is patchy (more in apical turn, also middle and basal in apical turn, also in middle and basal turn) or diffuse. Loss of strial function is thought to affect some vital quality of endolymph, causing lots of energy travailing to the end organ. Alteration in endocochlear potential (threshold increased) frequency selectivity reduced. Lack of degeneration of cochlear neuron accounts for excellent speech discrimination, until significant pure tone loss. Large intercellular space (stria vascularis made of 3 cell layers, Martinal cell are severely affected). Slow progression diameter of blood vessel vary among different individual a person with small diameter blood vessel with cholestrol corrosion experience greater degenerative changes than with efficient blood transport system. Impairment of function, rather than structure of hair call is observed in strial presbycusis. Gussen (1969) reported of plugging of vascular canal in otic capsule with age. Minimal hair cell loss.

Audiogram shows relatively flat sensory neural hearing loss good speech discrimination at hearing threshold level is less than 50 dB,if more than 50 dB speech drops. Endochlear potential threshold is increased







Cochlear conductive:

This is characterized by atrophy of spiral ligament, change in mass and stiffness of basilar membrane. Spiral ligament from childhood probably does not influence tonal threshold until problem become more than moderately pronounced. Shrinkage of supporting tissue (more in apex), loss of fibrocytes near the attachment area of basilar membrane. Less of cell in mid portion of ligament. Shrinkage of spiral ligament, alter the configuration of cochlear duct, cystic degeneration in spiral ligament. Basilar membrane actually separate from lateral wall. It may show calcification, hyalinization; atrophy, tissue filtration of foreign substances could contribute separately or in combination with spiral ligament shrinkage to alter motion mechanise of cochlear duct.

Audiogram shows descending or straight line beginning in middle age. Speech discrimination is directly related to the degree of pure tone hearing loss. sensory neural hearing loss is inordinate with respected to the mild loss of hair cell and cochlear neurons, and continues throughout life (Brody, 1955). When neuron loss is massive significant effect on hearing is noticed. Schuknecht and Woellner(1955) reported that spiral ganglion cell must approach 75 percent before any significant change in threshold occur.

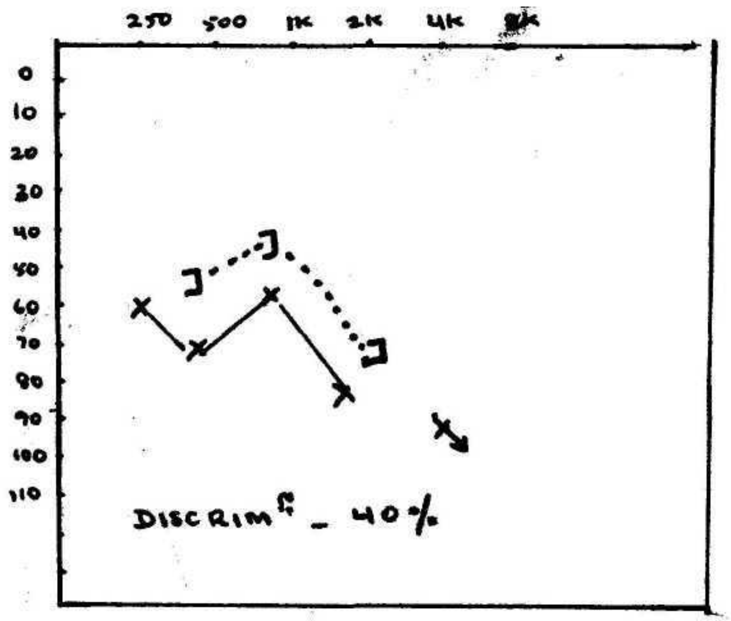
Krampotic and Nenanic (1971) reported narrowing of auditory nerve atructure attribute due to progressive deposit of connective tissue, osteoid and bone at the base of the internal auditory meatus. This may compress fibre of auditory nerve and thus atrophy of fibre.

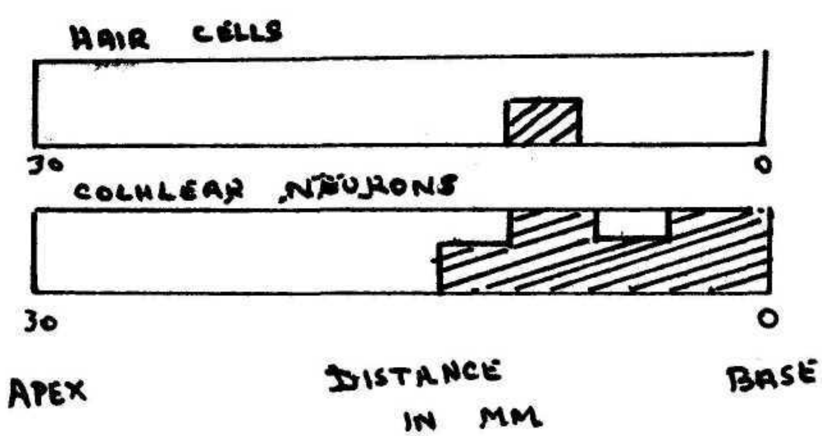
Pestalozza and Shore (1955) reported degeneration of glial part of the nerve thia reault in reduce speech discrimination ability less effedt on auditory acuity.

Hinchliffe (1962) reported rate of conduction of impulses is also reduced.

Brain stem and cortical structure:

Schuknecht (1964) reported deficit in the number of functional unit in 2nd, 3rd and 4th order neuron in addition to atrophy of Ist order neuron. Kirikae, Sato, Shifara (1964) reported atrophy of neural structure in ventral cochlear nucleus (VCN); superior olivary complex (SOC); literal leminiscus (LL); inferior colliculus (IC); medial geniculate body (MGB) and auditory cortex. Similar structural change has been reported by many other investigator alto (Brody, 1955; Cragge, 1975; Valenstein, 1980).





Central presbycusis:

A decline in central auditory functioning accompanies aging, which have promoted to alter the approaches, to aural rehabilitation for them.

The core of the nerve is made of apical fibre with basal fibre twisted around its periphery (Taraki, l958; Gulick, 1971). The peripherally situated fibres are more subject to damage and analysis of high frequency by besal neuron is hence most vulnerable. Loss of ganglion cell in spiral ganglion. Degeneration of ganglion cell of auditory nerve pathway (neural atrophy).

Dublin (1976) reported reparative gliosis of VCN, nerve cell degeneration and increased glial disruption of laminated pattern of inferior colliculus.

Fowler (1944) reported degeneration in nuclei, myelin sheath, intercellular tissue of cartical pathway, accumulation of facts iron diposits in perivascular space of cortex, senile plague on brain stem and temporal lobe.

Central effect of pure tone is more subtle, moderate to severe sensory neural loss flat or slightly sloping, phonemic regression, poor speech discrimination. Severe reduction of cochlear neuron in basal 15 mm of cochlea.

General consideration:

If one consider five categories of presbycusis, the diagnosis often does not full in one of this type. There is often more than one type of degenerative process present in a given ear. The diagnosis of preabycusis therefore based on the finding of a slowly progressive, otherwise unexplained symmetrical non-conductive hearing loss beginning in middle to older age. The pure tone threshold may remain unaltered for majority of cases but speech discrimination problem increase. Further there is decrease in directional hearing in aged. Their ability to determine very mail interaural time differences deteriorate.

Presbycusis is more than a simple loss of hearing. It is a complex disorder involving loss of speech discrimination and processing and perception of pure tones. Since vestibular system is intimately related to cochlea we shall briefly to through the vestibular dysfunction due to aging. Dizziness with sensation of unsteadyness, disequilibrium vertigo is more common complaint.

Histopathology of vestibule has not been studied as extensively as cochlea. But Rosenhall (1976) reported almost 40 percent decrease in the number of myelinated vestibular nerve fibre decrease in number of hair call in cristae and maculae.

Johnaon (1982) reported devascularization pronounced in vestibular system than in cochlea. Larger defect in otoconial layer, degenerative change in utricle saccule nerve and saccular otocomin.

Schuknecht (1974) described four types of disequilibrium.

1. Cupoblithiasis (postural vertigo, benign positional vertigo or benign paroxysmal vertigo).
2. Ampullary disequilibrium
3. Maculary disequilibrium not documented histologically
4. Vestibular ataxic.

Pure tone audiometrv and speech audiometrv:

Hull and Traynor (1975) reported that collapaed ear canel in the aged can be due to earphone pressure on soft tissue of the pinna. Therefore air-conduction will be poorer than bone-conduction giving rise to false conductive hearing loss.

Glorig, Nixon and High (1962) reported that high frequency hearing loss by middle ear lesion was because of elasticity loss in tympanic membrane and in ligament and muscle. Goodhill (1966) reported high frequency bone-conduction loss in lateral ossicular fixation.

According to Fletcher (1929), pure tone average in the so-called speech frequency (500 Hz, 1 KHz, 2KHz) is a relatively valid predictor of the intelligibility of normal speech.

Carhart (1958) described Bernero effect and he suggested that reduced bone conduction response at 500 Hz more likely a reflection of the central auditory dysfunction. Glorig and Davis (1961) described a high frequency air-bone gap that they ascribed to an age-related increase in stiffness of the cochlear partition. Air bone gap was in evidence at 4000 Hz increased from 10 dB at 50 years of age to 40 dB by 80 years of age. Nixon, Glorig and High (1962) found air bone gap at 4000 Hz only and it was not due to noise exposure and they sugggested pathological change in the connective tissue of the middle ear.

Jerger (1973) reported following characteristics of presbycusis.

1. Hearing loss with elevation of pure tone threshold and speech.
2. Distortion and abnormal adaptation
3. Ipsilaterality of symptom agreeing with peripherality of the rooting prior to central crossing.
4. Reduced ability to understand speech.
5. Reduced ability to transmit complex speech signal.

Acoustic immittance:

Middle ear system increasingly complaint upto middle age and then stiffness with further aging (Jerger, Jerger and mauldin, 1972; Albert and Kristensen,1972). Blood and Greenberg (1977) found decreasing admittance with increasing age in subjects of age 50 and higher Beattie and Leamy (1975) found admittance to bo higher in their elderly (age 60-70 years) as compared to the younger (age 17-29 years) group. Some investigators have shown no immittance change as a function of aging (Nerbonne et al 1978; Thompson, Sils, Recke and Bul, 1974). In all these studies, the subjects had normal hearing or sensory-neural hearing loss.

Jerger et al (1978) found decreased acoustic reflex threshold for pure tone and no change in acoustic reflex threshold for White noise with increasing age in normal hearing subject. Silman (1979a) found no difference in acoustic reflex threshold for pure tone between young and elderly normal hearing adults, but found increased acoustic threshold for white noise in the elderly subjects. Thompson, sils, Roche, and Bul (1980) found no changes in acoustic reflex threshold for either pure tone or filtered white noise as a function of age for normal hearing adult, but did find decreased growth of the acoustic reflex to those stimuli with increasing age.

Little is known concerning change in tympanogram that might be related to the aging process. An increased incidence of tympanogram types associated with ossicular abnormalities (i.e. stapes fixation) has been observed with advancing age (Jerger, 1970).

Speech discrimination:

Jerger (1973) reported that a decrease in PB Max with aging was similar to that decrease in absolute sensitivity with aging. Jerger also examined mean PB Max scores as a function of age forthe group with varying degree of hearing loss and observed slight decrease in PB Max, with age when presentation level was sufficiently intense to over come the attenuating effect across all frequencies.

Beaa and Townsend (1977) found age effects in the speech discrimination abilities of 556 subjects with flat hearing loss in the age groups of 14-98 years. For mild hearing losses the discrimination ability as 40 dB SL, decrease very slightly with age. For greater amount of hearing loss speech discrimination decreased dramatically with age.

Luterman, Welsh and Melrose (1966) found more errors in elderly than young listener on W-22 word list at 46 dB SL. surr (1977) did not find any difference between the young and the elderly listeners with mild, moderate, gradually sloping hearing loss at any presentation level.

The elderly people generelly experience difficulty with a11 type of altered (i.e. frequency related or temporally related alteration) speech (schow et el. 1978), but there are many inconsistence across studies.

Discrimination of low pass filtered speech has been measured by Kirikae et el (1964) and Marston and Goetzinger (1972) and discrimination of band pass filtered speech by Harbert et al (1966) and Palve and Jokinen (1970); Marston and Goetzinger did not find differences between young and older listener.

The elderly have demonstrated decreased performance on fast speech (Bergman, Blumenfeld, Cascardo, Dash, Levitt and Margulies, 1976; Calearo and Labberroni, 1957), interrupted speech (Bergman, 1975; Bergman at al 1976; Kirikae et el 1964 and Marston and Goetzinger, 1972) and Reverberated speech (Berman, 1971; Burgean at al, 1976). There is disagreement about the effect of time-expanded and time compressed speech. Luterman et al (1966) and Schon (1970) found that discrimination of time expanded speech was affacted by hearing loss but not age. Korabic, Freeman and Cherch (1978) found poor performance for the elderly sistener, where elderly listener had high frequency sensori neural hearing loss and poor speech discrimination score for unaltered speech and test words were presented at relatively low sensation level.

Perception of time altered speech by the elderly listener with normal hearing sensitivity (threshold lesser than 15 dB ISO at 250-4000 Hz) has been assessed by Sticht and Gray(1969). Intelligibility deteriorated progressively in comparison with young listeners for increasing time compression.

Luterman et al (1968) found no differenee between the young and the elderly listener with similar high frequency hearing loss, but used relatively low level alteration. Scohon (1970) found similar performance among older listener with typical sloping presbycusis hearing loss. Older listener with sizeable hearing loss and younger listener with sizeable hearing loss. Sticht and Cray (l969). Konkle, Beasley and Bess (1977), however, both found that with increase in time, compression the elderly hearing impaired subjects showed no increasingly larger decrement in speech discrimination An comparison to young hearing impaired subject.

In listener with peripheral hearing loss the problem is much more complex. Harris (1960) demonstrated in young normal listener that combination of various types of distortion resulted in worse speech intelligibility. Thus the results of many of the altered speech studies using elderly listener are difficult to interpret because peripheral hearing loss could have accounted for these effects. Konkle et al (1979) matched audiogram across age group and they found large effect of age on the intelligibility of time compressed speech, especially in more difficult listening condition.

Smith and Prather (1971) found a decrement for the elderly listener in comparison to young listener for speech discrimination of consonant vowel (cv) nonsense syllable across range of SLS and signal to noise ration (S/N) using broad band noise. Orchik and Burges (1977) found decrement for their older listeners in comparison to younger listener only for their more difficult S/N ratios using synthetic sentence identification (SSI) with competing speech masker across a change of message-to-competition ratios (MVR). Orchik and Bergen found poor performance for increasingly difficult listening condition as found by Sticht and Gray (1969); and Konkle et al (1977) for time compressed speech where as Smith and Prather (1971) did not find increasing difficulty in the more difficult condition for elderly subjects when compared to young listener.

Surr (1971) found no difference in speech discrimination scores in noise among 100 listener age 30-90 years, with matched audiogram and similar result reported by Olson and Carhart (1967) and Tillman et al (l970) for a smaller sample of listener whose audiogram was not matched.

Hayes and Jerger (l979) found that not all elderly listeners show problem with speech in noise task. Similarly, Leshowltz and Lindstrom (1979) found that most but not all listeners with presbycusis hearing losses required increased S/H ratio to understand connected discourse.

Peripheral and central factor are difficult to differentiate, Leshowitz and Lindstorm(1979) attributed to difficulty with speech-in-noise that was seen in listeners with hearing loss due to presbycusis, ototoxicity and nosie trauma to a loss of frequency selectivity as was measured by upward spread of masking. Presbycusis subjects showed an increased upward spread of masking in comparison to other listener and concomitantly to need a greater S/N ratio for speech intelligibility. Plomp and Mimpen (1979) found that the speech reception throahold (SRT) in noise relative to SRT in quite may even be better for listener with presbycusis than listeners with othor sensory neural hearing loss. Jorgar and Hayes (1979) howover attributed to the elderly relative difficulty on the synthetic sentence identification-ipailateral competing message (SSI-ICM) task to a central auditory nervous system deficiency since discrepancy between PBMax and SSI Max, follow the same pattern as seen for listeners with central auditory disorder.

Binaural hearing for speech:

Binaural fusion has been assessed by Herbert et a1 (1966) and Palva and Jokinen (1970) using listeners upto age 90 years. Even elderly listener showed poor speech discrimination ability on monoaurel filtered speech test in comparison to young listeners, binaural synthesis created no additional problem. Franklin (1975) found similar result with young hearing impaired listener.

Binaural interaction was assessed by measuring the masking level difference (MLD) by many investigator (Bocca and Antonelli, 1976; Finlay and Schuchman (1976); Olson and Nuffsinger, 1976 and Herman 1978). Persons with presbycusis hearing loss showed smaller mean MLD than did the normal hearing listeners, although there was considerable overlap in MLD size between two groups. While abnormal MLD are seen in person with brain-stem lesion Olson et al (1976) demonstrated that persons with peripheral impairment showed reduced MLD and Quranta, Cassano and Cervellera (1978) concluded that MLDs (for 500 Hz tone) were not useful diagnostically to detect central impairment unless peripheral hearing impairment was normal. On both studies 40 percent to 60 percent of listeners with presbycusis hearing losses obtained MLDs within normal limit. MLDs have not been measured systematically in the elderly listener with normal hearing sensitivity or in young listener with slight hearing loss.

Loudness and adaptation:

The alternate binaural loudness balance test (ABLB) cannot be used for listener with presbycusis since their hearing is bilateral symmetrical. Recruitment was measured by pestalozza and Shore (1965) and Harbert young and Mendike (1966) in elderly subject using monoaural bifrequency loudness balance test (MLB). They found many elderly subject did not show recruitment on this particular test.

Jerger, Shedd and Harford (1959) found vide range of short increment sensitivity index (SISI) scores in presbycusis patient. Young and Herbert have not found difference between presbycusis and various cochlear etiologies for SISI score. A range of sound pressure level or high level. Bergholtzs, Hooper and Meheta (1977) have found little agreement between recruitment indices of acoustic reflex sensation level and electrocochleagraphy (ECochG) input output curves and found no consitent pattern of recruitment in listener with prebycusis hearing loss. Jerger (1973) have found no difference in speech discrimination score of recruiting and non-recruiting elderly listener using sensetional level of acoustic reflex as the recruitment measure.

Adaptation:

Many investigators have used Bekesy audiomotry or tone decay tests to measure adaptation. Bekesy tracing are usually type-I or type-II (normal or cochlear site of lesion) for presbycusis subject (Herbert et al 1966; Jerger, 1960; Joktner, 1969;1970) and show no abnormal fatigue. Forward and backward Bekesy tracing did not show evidence of abnormal fatigue (Joknen and Kerye, 1970). The amount of adaptation usually seen on clinical tone decay test is 30 dB or less (Gang, 1976; Gjaevenes and SoHoel, 1969; Olsen and Nuffsinger, 1974), again consistent other etiologies associated with cochlear site of lesion. Willeford (1971) reported abnormal tone decay for only a small number of elderly subject. Thus preabycusis subject usually do not show the abnormal fatigability that would be expected with retrocochlear site of lesion, but it is important to measure rate as well as amplitude of adaptation (Wiley and Lilly, 1980).

Frequency analysis:

Auditory analysis of speech signals clearly is dependant upon frequency analysis. Without good frequency analysis abilities speech discrimination abilities are impaired (Gengel 1973; Linuille and Bendt, 1980).

Frequency discrimination tends to be poor aa the hearing loss increases in case of cochlear pathology both for frequency modulated signal as well as pulsed sinusoids (Gengel, 1975).

Meurmann (1954) and Filling (1958) have studied frequency discrimination with frequency modulation (FM) technique in elderly hearing impaired listener. Meuremann have found that difference limen for frequency (DLF) at 20 dB SL for 125 Hz - 4000 Hz were larger than normal in aging listener but certainly were no larger that the DLF for liatener with menier's disease or young listener with sensory neural hearing loss who have poorest hearing sensitivity. Filling have found that DLF at 20 dB SL for 125 Hz - 8000 Hz worse for older listener. Filling have concluded that DLF may show adverse effect on aging even before a loss of hearing sensitivity is observed.

Psychophyaical tuning curve show abnormal broadening, abnormal shape and loss of the tip in the region of hearing loss (Tyler, Fernandes and Wood 1980). They can also show abnormality in region of normal hearing sensitivity (Mills, Gilbert and Adkins, 1979) especially if there is a sizable loss for higher frequency (Nelson. 1979).

Loudness measure of critical band width in 20 presbycusis listener who had fairly flat audiogram showed normal critical band width (Bonding, 1979). Magnitude of loudness summation was reduced in sensory neural hearing loss especially in ear with recruitment and magnitude of loudneas summation varied inversely with hearing loss (Bonding, 1979).

Simultaneous masking:

Two aspect of simultaneous masking has been assessed in experiment with elderly listener one of this is critical ratio is the signal to noise ratio at measured threshold and second upward spread of masking, is the extent to which the influence of masker spread to higher frequency.

Critical ratio are usually found to normal for listenear with cochlear heariag loss (Jerger, Tillman and Paterson, 1960; Rittmani (1962) aad appear largely unaffected by a level in either normal listener or listener with cochlear hearing loss (DeBoer and Bowmeester, 1974; Palma, Goodman and Hirsh, 1953). Bilger (1973) found critical ratio to increase with level for higher frequency for normal heariag listener. Margoli and Goldberg (1980) have measured critical ratio in five presbycusis listener for a 1000 Hz tone as 50 dB SPL, where four subject showed abnormal critical ratio.

Abnormal broad upward spread of masking has been observed for some but not all listener with sensory neural hearing loss (De Boer and Bowmeester, 1974, Jerger et al. 1960; Tylar et al. 1980).

Jerger et al (1960) found abnormal spread of masking for adult listener with sensory neural hearing loss (cochlear hearing loss) and elderly listener with presbycusis. However the elderly listener did not show greater spread of masking effect than their young counterpart. Jerger (1973) stated that the problem is attributed to impaired central auditory pathway in the elderly.

Electrocochleography findings:

Latency amplitude and wave form of the action potential were studied in a group of patient with presbycusis, noise induced hearing loss, sensory neural hearing loss of unknown etiology and conductive hearing loss. As a maximum stimulus intensity of 75 dB HL, patient with moderate to severe high frequency sensory neural hearing loss had the longest latency. Smaller amplitude with increasing hearing loss and when sleep amplitude-intensity curve are found, the amplitude often reaches larger than normal value at the maximum stimulus intensity. These patient showed the same amplitude-intensity latency-intensity pattern. The latency at the action potential was larger than that for a normal subject at the same stimulus level (Bergholtz, Hooper and Mehte, 1977).

In case of mild or moderate sensory/neural hearing loss (Portman Aram and Lagourgue, 1973) have reported recruiting response for clicks. The recruiting aspect of the response is that it will grow in amplitude very rapidly and it will not show the gradual increase in amplitude with near threshold signal level as seen in the normal hearing or conductive hearing loss patient.

Aram (1971) also obtained dissociated response with high frequency (except for 8 KHz sensory neural hearing loss subject) when clicks are used.

Middle latency responses:

Mcrandle, Smith and Goldstein, 1974; Goldstein and Merandile 1976; Medle and Harker, 1977 have reported that there is little difference between adult and infant morphology for middle component as a function of intensity or rate of stimulus presentation. Neonates demonstrate slightly shorter latency and smaller amplitude than to adult.

When hearing impaired individual are compared McFarland et al 1977; Vivien at al 1979 have found few systematic and reliable difference in middle latency wave form compared to normal at the same suprathreshold intensity level.

Late latency component:

Maturation and maturity affect the latency of these component. They decrease in latency from birth to 10 years of age and lengthen there after. The amplitude increase in childhood and than become stable, eventually decreasing with advancing age (Cellaway end Halliday, 1973; Ellingson, Danahy and Nelson et al 1974; Goodin, Squires and Henderson et al. 1976; Pfefferbaum. Ford, and Roth et al. 1980a, 1980b).

Lone latency component:

Latency of the P_3 component has been found to increase as a function of age of subject (Squires, Chippendale and

Wrege et al 1980) latency difference between young and older subject after the N_1 component but not before (Goodin et al 1978a).

Age effect on auditory brainstem response (ABR):

The peak of wave V can be measured from the peak to wave I. Tha usual time differerence between peak V and peak I is about four milisecond and is remarkably consistent especially in normal subject.

Rowe (1978) and Bealglery and Heldrake (l978) investigated the effect of age and sex upon wave latencies. Rowe (1978) demonstrated significant difference between young and old subjects. While Beagler and Sheldrake (l978) found significant difference in regard to sex, but not in regard of age.

Rosenhammer et al (l980) found no significant latency differece between male and female among the old subject. Shorter peak latencies in female who are below 50 years than man and it was not significant above the age of 50 years.

Rosenhemmer et al (1980) found an increase of the III-v (and I-v) interval that was significant within old subjects but not in young ones, when the click intensity is reduced from 80 to 60 dB SPL(Click rate 22.5/sec).

In subject with normal hearing, latency increased by 0.2 msec. ever the age range from 25 to 55 years. In the same group amplitude of wave V was decreased about 10 percent (Jerger and Hall, 1980).

Rosenhammer at al (1980) found that I-V peak latency was conatant and independent of hearing loss and age.

McCandless (1982) found that the latency ef wave V was alightly longer for elderly subjects than for younger one.

Maurizi et el (1982) found a significant prolongation of I-V inter peak latency in old person with preabycusis indicating age related change not only involve the end organ but also brain stem structure.

Rosenhall, Pederson and Dotevall (1986) in their study reported age related delay of the later ABR wave (IV, V) with age was particularly pronounced for individual of both sexes with slight to moderate hearing loss. Wave I and wave III also shown lengthened latencies with age but to a lesser extent than the later wave. The I-V inter peak latency is significantly prolonged with age particularly for individual with slight to moderate hearing loss.

METHODOLOGY

The aim of the present study is to establish pattern of hearing loss at the inmates of old age home as a fanc- tion of age and to study other audiological manifestation exhibited by the group.

Subjects:

A total of 50 subjects were selected among inmates of old age home. Age range of the subjects were from 50 years to 80 years. Subjects were categorized into three groups 50 years to 60 yearay 60 years to 70 years and 70 years to 80 years based on their chronological age. All the subjects were otologically normal and had no otological complaint of any sort of hearing loss. A sample of history sheet used to gather their information is given in appendix-A.

Equipments:

For obtaining pure tone thresholds a single channel diagnostic audiometer (Damplex) with earphone (TDH-39) set in supra-aural ear cushion (MX41/AR) was used for all the subjects.

The instruments were calibrated as per ANSI (1973) standards of the audiometer was maintained using Bruel and

Kjaer calibration unit which consisted of an artificial ear (B&K 4152), sound level meter (B&K 2203) with an octave filter set (B&K 1613), in a sound treated room. Periodic cheking was employed to keep the unit in calibration throughtout the period of study. The procedurad used in calibration is given in Appendix-B.

An impedance meter (Madsen OB 822) equipped with ear-phone TDH-39) aet in supra aural ear cushion (MX41/AR) was used for impedance screening

Test environment:

Pure tone testing, tone decay teat and impedance screen-ing was done in a room whose ambient noise was measured using a sound level meter (B&K 2203). the noise level was found to be sufficiently low as not to interferes with threshold testing.

Test procedure:

Impedance screening:

For each subject tympanometry, compliance and reflexo-metric measurement were done to rule out middle ear pathology.

Tympanogram was obtained with a 220 Hz probe tone for both ears of the subject. Then, the contralateral reflex thresholds were measured, for frequency ranging from 250 Hz to 4000 Hz at octave intervals.

Subjects, who had a normal pressure peak (± 50 mm H_2o) and reflexes present in both ears, were included for the study.

Pure tone testing:

The conventional procedure was used for pure tone testing and thresholds were obtained using the modified Hughson and Westlake procedure (Carhart and Jerger, 1959). The pure tone thresholds were obtained for seven frequencies ranging from 250 Hz to 8000 Hz at octave intervals. Both ears of the subjects were tested once at a time. Similarly bone conduction threshold were also obtained. Prior to commencement of testing the instruction given to the subject wore as follows:

I am going to tost your hearing, by presenting different kind of test tone to your ears, through the earphone. First, the tone will be presented at a level you can wall hear. As soon as you hear the tone raise your finger and hold it up as long as you are hearing the tone. As soon as you donot hear the tone, put the finger down immediately. Level of the tone will be varied but each time the tone is heard, even for the faintest you should indicate. Only one ear will be tested at a time. Are you ready?

Procedure for tone decay test:

Olsen and Noffsinger's (1974) complete tone decay test was administered to all the subjects. Here the tone is presented continuously at 20 dB SL at 500 Hz, 1000 Hz, 2000 Hz for one minute. When the subjects fails to hear the tone intensity of the tone will be increased by 5 dB step without interupting the tone until the subject hear for one minute. Test should be continued until 35 dB SL is reached. If the subject fails to hear 60 secs at 35 dB SL, the test is terminated. Tone decay test is positive.

Subject was instructed. The subject is seated in an armchair and told to maintain elbow contact with the armest while he is signalling. He is trained to rise his arm perpendicular to armeat if he perceives the stimulus as tonal, to lower it to a 45^{o} angle if the stimulus looses tonality but remained audible and to lower his arm to rest position if the sound become completely inaudible. The patient is cautioned against adjesting earphone or chewing while the test is in progress.

Definition of terms:

Air conduction: This refer to the mode of listening where the auditory/acoustic stimuli are transmitted to the inner ear through external and middle ear.

Audiogram: The audiogram ia the graph on which pare tone threshold are recorded. It usually has provision for recording thresholds at octave and seme half octave interval from 125 Hz through 8000 Hz. Pure tone audiogram had following characteriatics, frequency in Hz should appear along the abscissa on a logarithmic scale and hearing level in dB should appear along the ordinate or a linear scale.

Frequency: The number of cycles per second of a wave or other periodic phenomena.

Intensity : The magnitude or degree of tension activity or energy; refers to the measure of the energy flow acting to produce a sound wave.

Presbycusis: The diminution of hearing acuity associated with old age.

Tone decay: Change in tonality and audibility of the stimulus within one minute.

RESULTS

The data was collected for pure tone air conduction and bone conduction thresholdS for 50 subjects from inmates of old age home in right and left ear separately at 7 test frequencies i.e. from 250 Hz to 8000 Hz at octave intervals. Then statistical analysis was done. Measures of mean, median and standard deviation was computed for each age group for each ear at all test frequencies for both males and females, Median values were computed for plotting the audiometric curve.

Audiometric profiles for males and females, for three age group was prepared by plotting the median threshold values for respective age groups as a function of frequency. The profiles for the right and left ears are given separately.

Analysis of data has been presented below:

Effect of age:

Mean hearing thresholds presented in tables 1 to 4 indicate that hearing thresholds increase with increase in age. Standard deviation which is computed for measure of variability revealed greater variability as age increases.

Audiometric profiles also shows the age effect which is manifested by a horizontal and vertical shift in the audiometric centre for the whole sample.

There is significant increase in threshold was observed with increase in age across all frequencies in right and left ears and for both males and females.

Effect of sex:

In general, mean hearing threshold for males and females did not show any difference as such. Maximum shift in threshold was observed between 5th to 6th decade in females where as it was between 6th to 7th decade in the male. Females of 60 to 70 years consistently showed higher threshold across all frequencies compared to males.

Maximum hearing loss was observed at 8000 Hz in both males and females. Increase in hearing level in males and females was equivalent at low frequency but at high frequency the increase was more in males than in females. Standard deviation scores, also showed an increase in variability with age in both males and females. Average increase in variability was slightly more in females than in males.

Audiometric profile for males and females does not show a consistent sex difference across frequencies and age groups.

Tone decay test:

Complete tone decay test of Olsen and Nuffsinger's (1974) was administered. All of the subjects did not show any tone decay at the frequency range 500 Hz, 1000 Hz, and 2000 Hz.

Fiji Age curves Males : Right ear

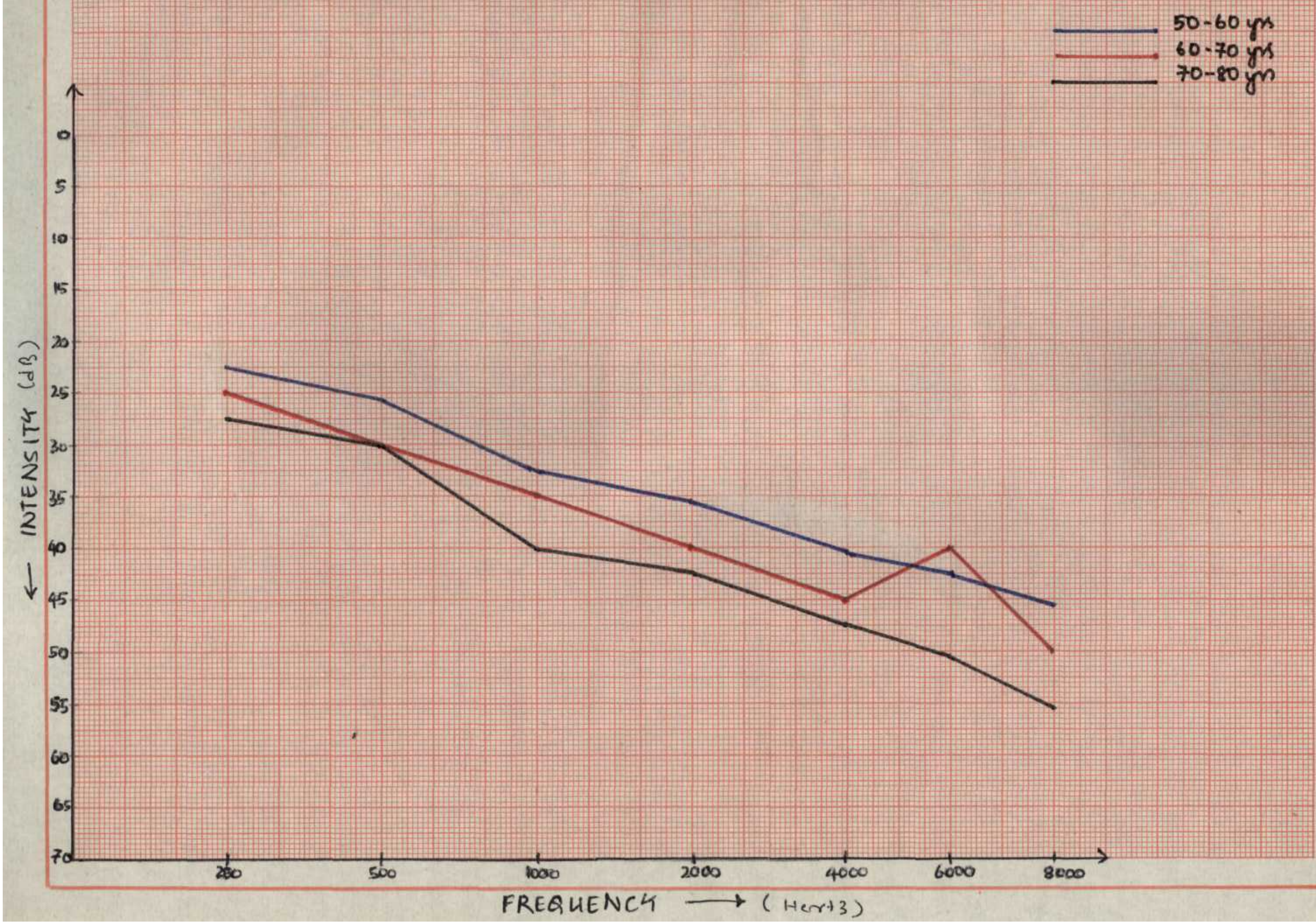


Fig2 Age curves Males : Left ear

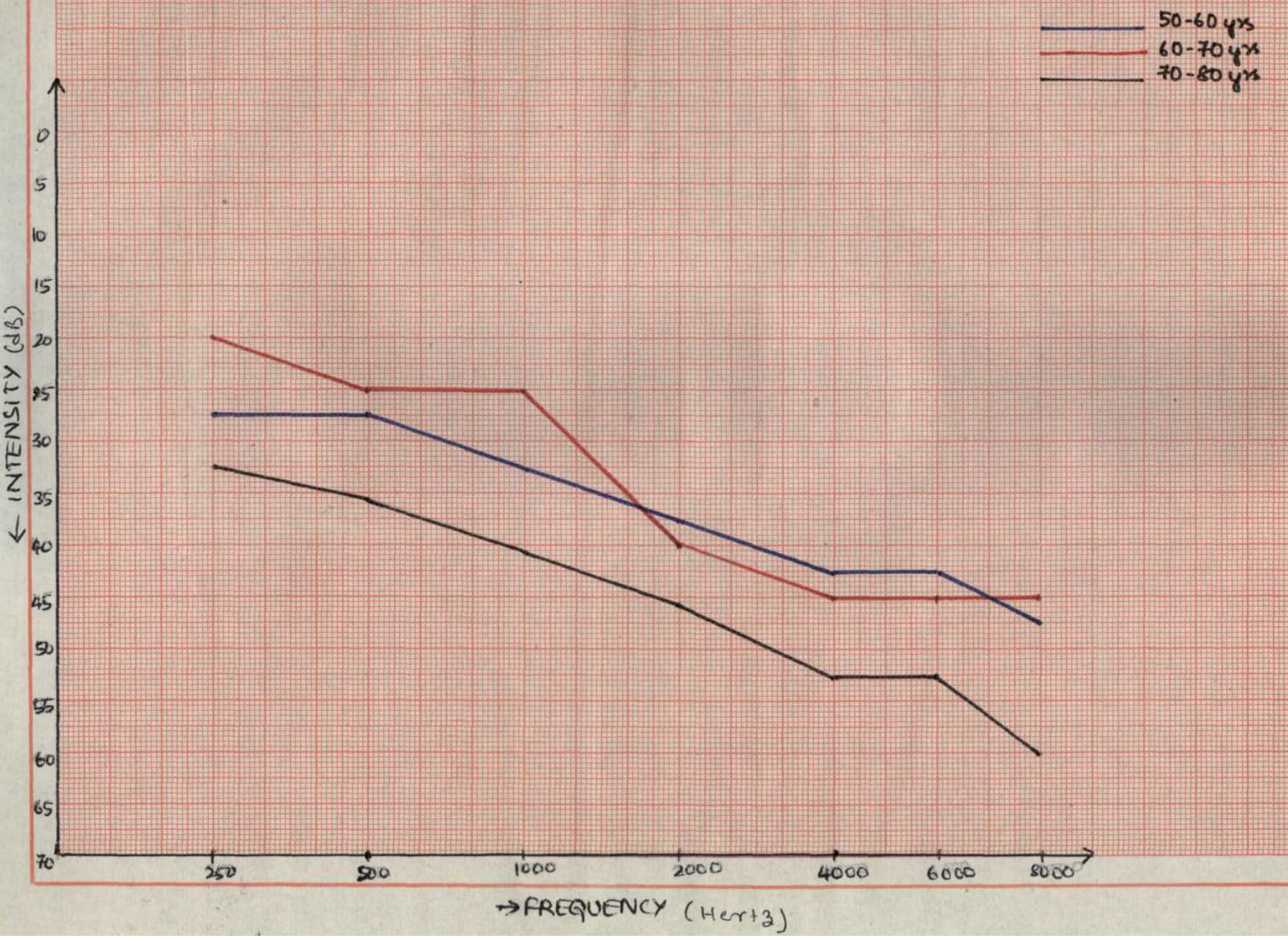


Fig 3 Age curve in Females: Right ear

Fig 4 Age curves Females: Left ear

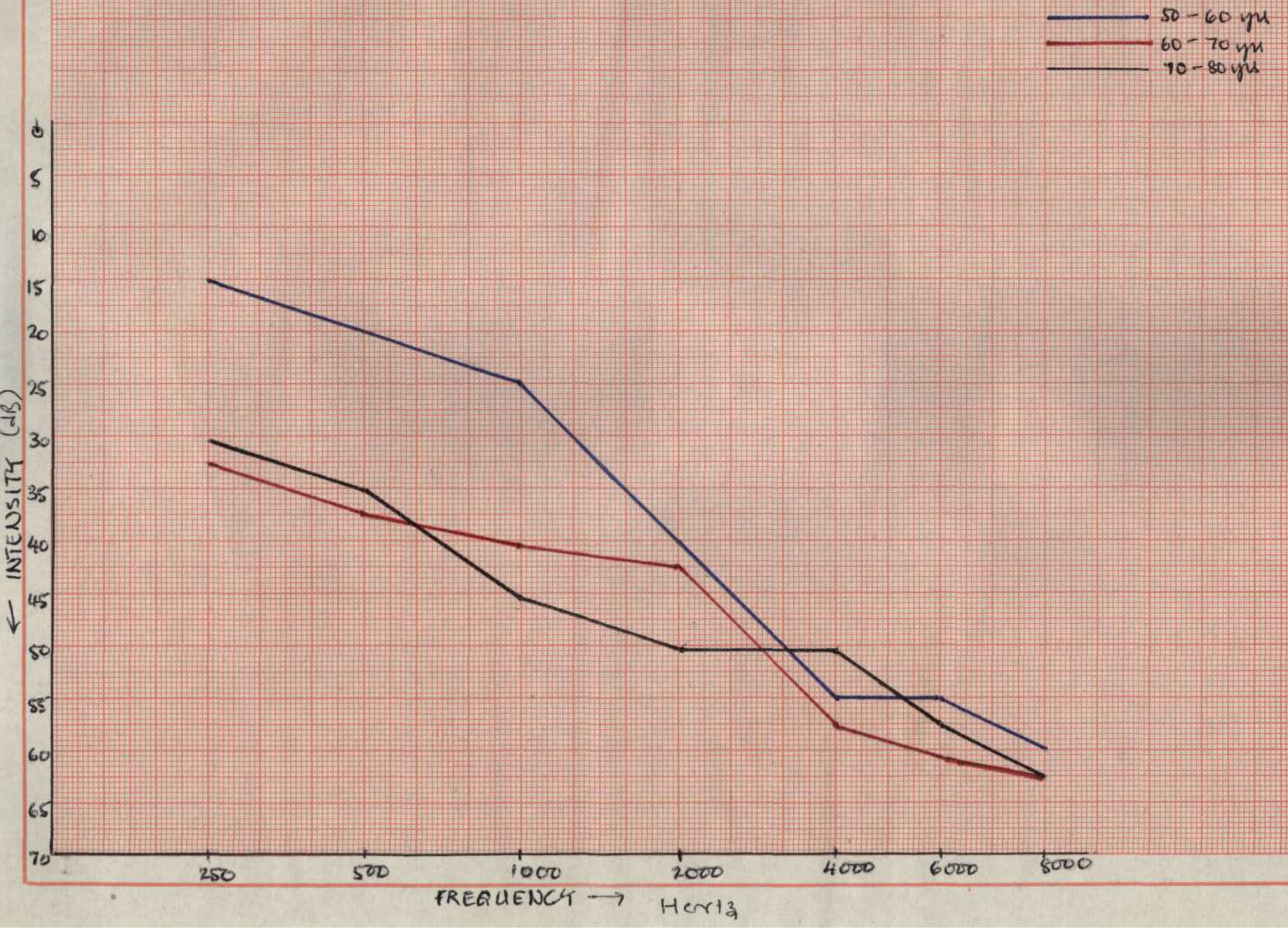


Fig 5 Males: Right ear frequency curves

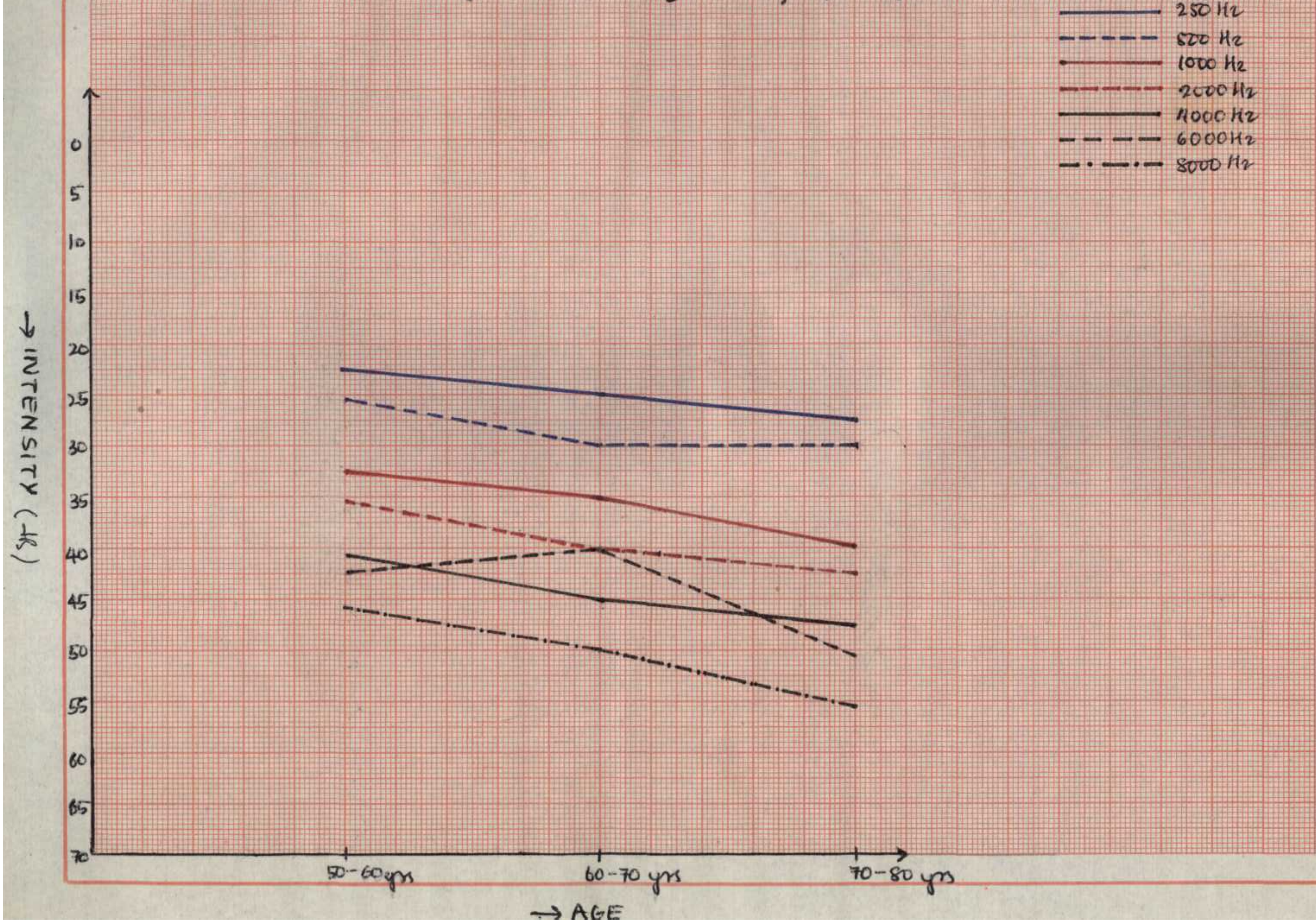


Fig 6 Males : Left ear frequency curves

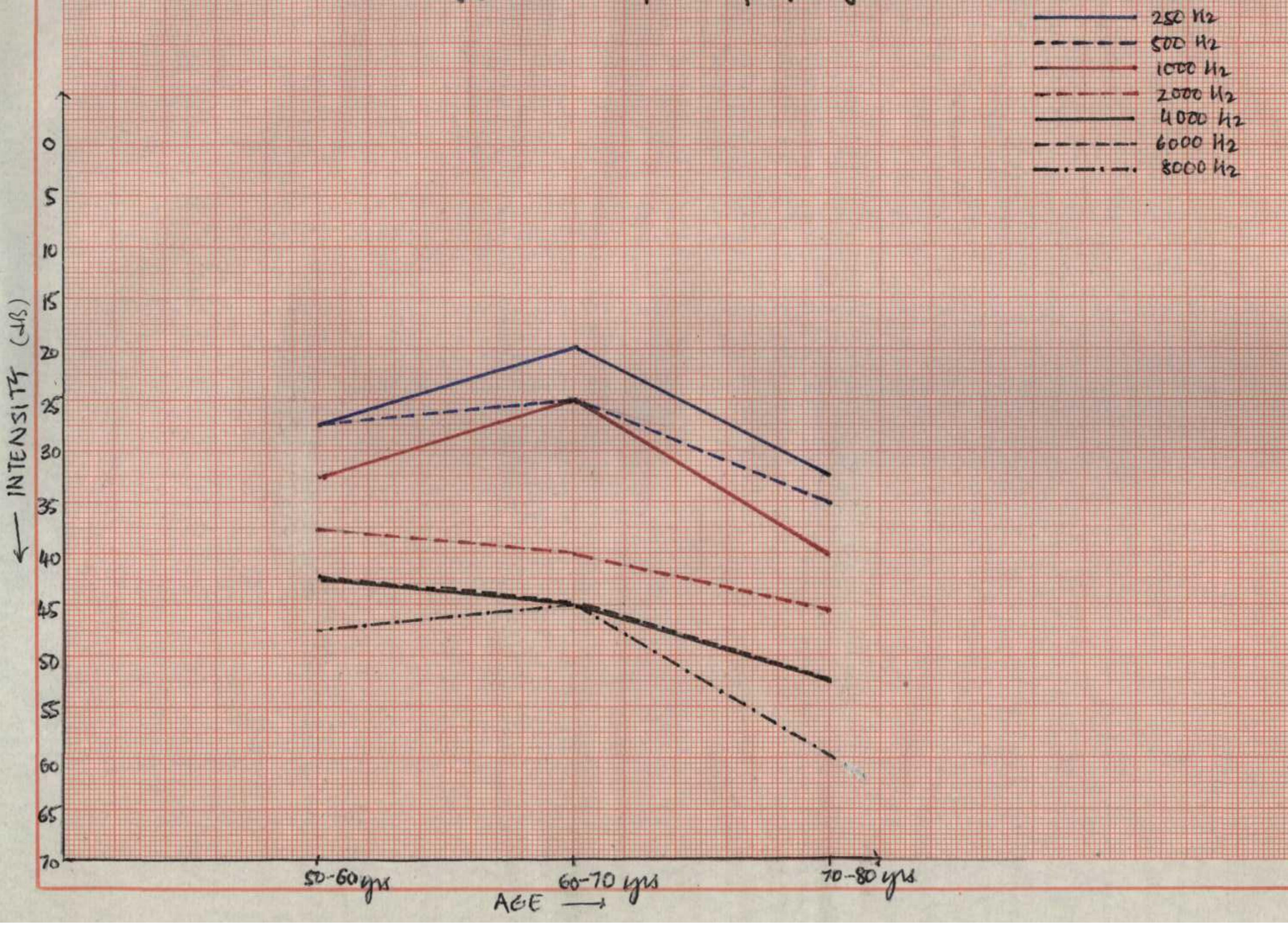


Fig 7 Females : Right ear frequency curves

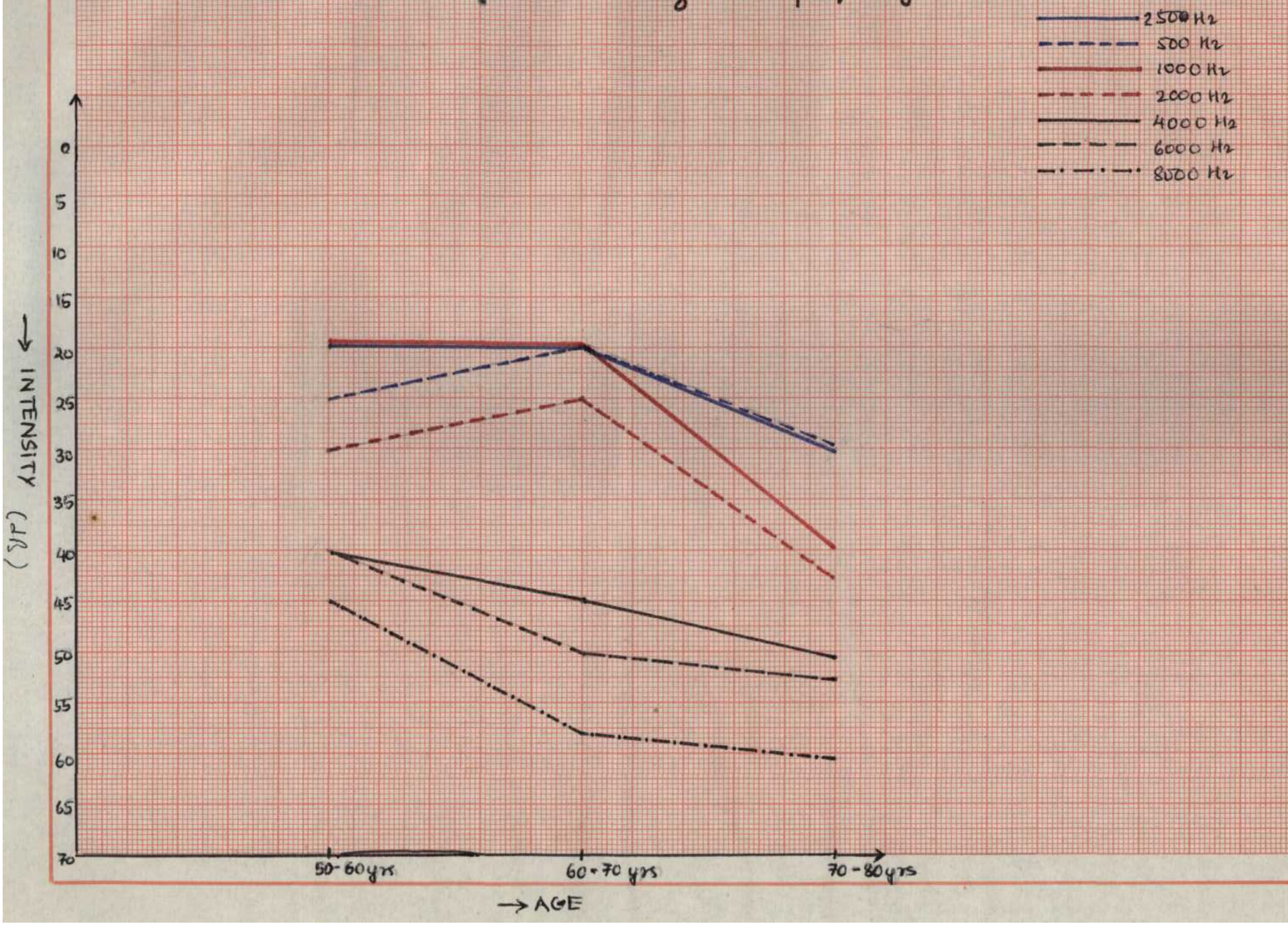
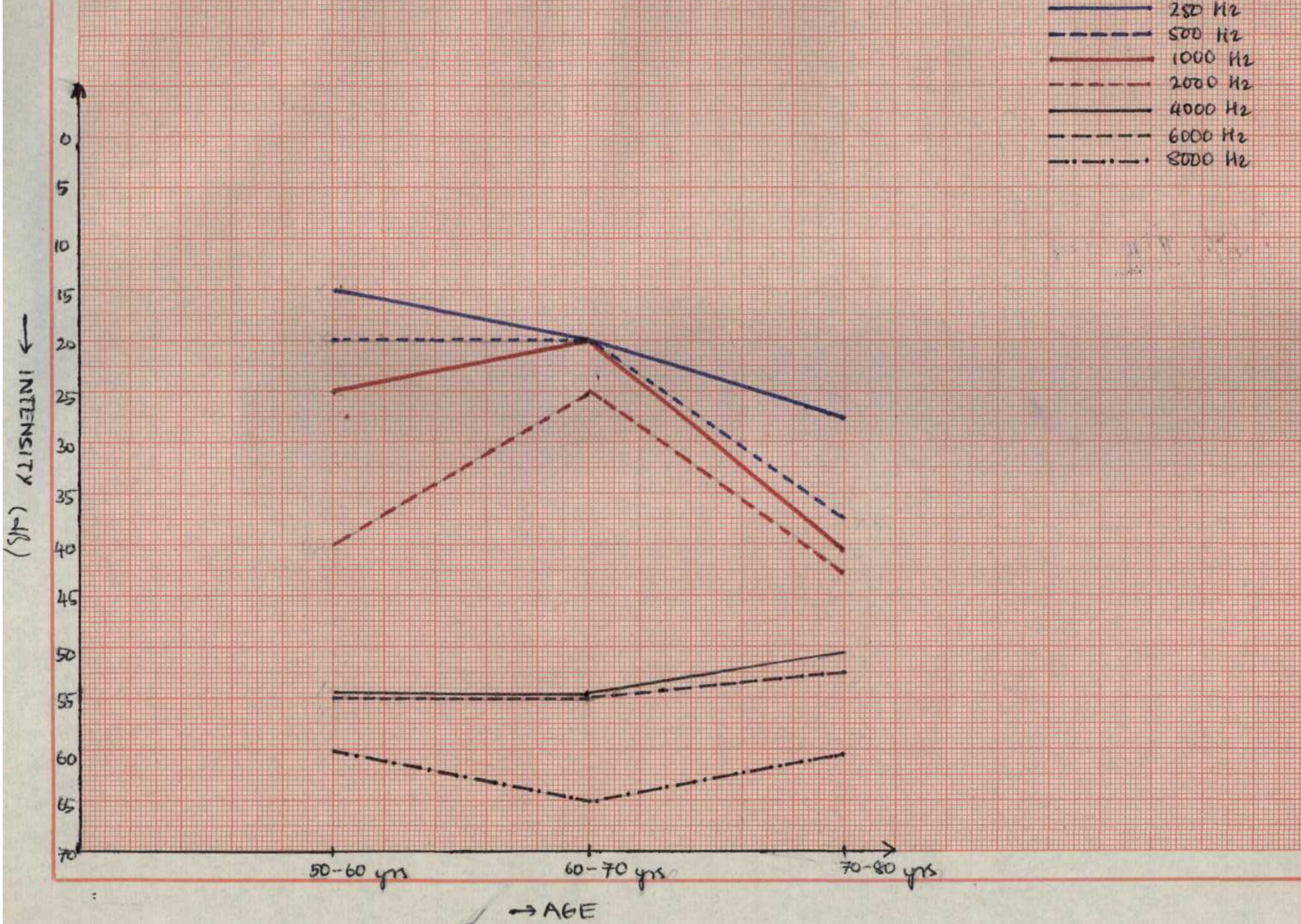


Fig [illegible] Females: Left ear frequency curve



Frequency	50-60 years	60-70 years	70-80 years
250 Hz			
Mean	23.75	25	29
Median	22.5	25	27.5
S.D	6.8	16.73	13.1
500 Hz			
Mean	26.8	27.85	32.5
Median	25.5	30	30
S.D.	7.5	13.32	13.15
1000 Hz			
Mean	31.9	32.14	40.5
Median	32.5	35	40
S.D.	7.1	13.05	13.21
2000 Hz			
Mean	36.25	37.14	44.5
Median	35.5	40	42.5
S.D.	6.5	13.05	10.59
4000 Hz			
Mean	40.6	40	51
Median	40.5	45	47.5
S.D.	7.26	13.6	13.19
6000 Hz			
Mean	43.5	44.28	52
Median	42.5	40	50.5
S.D.	5.5	12.9	13.45
8000 Hz			
Mean	47.5	50	59.5
Median	45.5	50	55.5
S.D.	7.9	12.8	14.00

Mean, median and Standard deviation scores at 250 Hz, 500 Hz, 1000 Hz, 2000 Hz, 4000 Hz, 6000 Hz and 8000 Hz for right ear males of three age groups.

- S.D. - Standard deviation.

Frequency	50-60 years	60-70 years	70-80 years
250 Hz			
Mean	26.25	22.8	31
Median	27.5	20	32.5
S.D.	5.4	8.39	11.35
500 Hz			
Mean	30	25	33.5
Median	27.5	25	35.5
S.D.	7.9	8.86	9.79
1000 HZ			
Mean	33.12	24.2	38.5
Median	32.5	25	40.5
S.D.	6.5	9.03	8.67
2000 Hz			
Mean	36.9	39.2	44.5
Median	37.5	40	45.5
S.D.	8.6	12.65	9.12
4000 Hz			
Mean	41.8	45	51.5
Median	42.5	45	52.5
S.D.	7.04	9.2	3.16
6000 Hz			
Mean	43.75	47.8	55
Median	42.5	45	52.5
S.D.	6.9	9.5	12.44
8000 Hz			
Mean	49.37	51.4	60.5
Median	57.5	45	60
S.D.	7.5	12.16	12.76

Mean, median, standard deviation scores at 250 Hz, 500 Hz. 1000 Hz, 2000 Hz, 4000 Hz, 6000 Hz, and 8000 Hz for left ear of male at three age groups.

S.D - Standard Devision.

Frequency	50-60 years	60-70 years	70-80 years
250 Hz			
Mean	23.3	22.66	30
Median	20	20	27.5
S.D.	4.7	11.32	13.09
500 Hz			
Mean	26.7	23.66	37.5
Median	25	20	37.5
S.D.	6.7	16.02	11.69
1000 Hz			
Mean	21.6	24.33	41.07
Median	20	20	40.05
S.D.	10.2	13.74	14.29
2000 Hz			
Mean	31.7	26.33	47.14
Median	30	25	42.5
S.D.	6.2	11.09	17
4000 Hz			
Mean	45	46	53.5
Median	40	45	50.5
S.D.	7.07	14.90	17.91
6000 Hz			
Mean	45	51.66	52.14
Median	40		52.5
S.D.	7.07	50	16.76
8000 Hz		14.22	
Mean	50	59	59.6
Median	45	58	60.5
S.D.	7.07	19.56	16.41

Mean, median and standard deviation scores at 250,Hz, 500 Hz, 1000 Hz, 2000 Hz, 4000 Hz, 6000 Hz, and 8000 Hz, for right ear female at three age groups.

S.D - Standard deviation.

Frequency	50-60 years	60-70 years	70-80 years
250 Hz			
Mean	20	20	30
Median	15	20	27.5
S.D.	7.07	8.01	13.09
500 Hz			
Mean	25	20	37.5
Median	20	20	37.5
S.D.	7.07	8.01	11.69
1000 Hz			
Mean	26.7	23.00	41.07
Median	25	20	40.5
S.D.	6.2	11.14	14.29
2000 Hz			
Mean	36.6	27	47.14
Median	40	25	42.5
S.D.	4.7	15.50	17
4000 Hz			
Mean	51.6	52.6	53.5
Median	55	55	50.5
S.D.	4.7	14.8	17.91
6000 Hz			
Mean	51.6	51.6	52.14
Median	55	55	52.5
S.D.	4.7	14.7	16.76
8000 Hz			
Mean	56.6	56.6	59.6
Median	60	65	60.5
S.D.	4.7	20.15	16.41

Mean, median and standard deviation scores at 250 Hz, 500 Hz, 1000 Hz, 2000 Hz, 4000 Hz, 6000 Hz and 8000 Hz for left ear female at three age groups.

S.D - standard deviation.

DISCUSSION

Effect of age:

A significant effect on the hearing acuity was observed in the older age group. The degree of hearing impairment with age was more at high frequencies in both men and women. This finding is in agreement with findings of several other studies (Corso, 196;? Goetzinger, 1961; Selh and Kacker, 1971; Punnan, 1976; Indrani, R. 1981).

In the study by Corse (1963), the hearing acuity was within 20 dB at low frequencies (250 Hz, S00 Hz, 1000 Hz, and 1500 Hz) even in the oldest age group.

Results of the present study varies slightly from Corso's (1963) findings. From 50 years to 70 years age, group threshold within 30 dB at frequencies lower than 1000 Hz, In the oldest age group that is 70 years to 80 years at 600 Hz, itself threshold is above 30 dB. This implies that onset of hearing loss as a function of age is frequency dependent. Fieldman and Reger's (1967) study supports the above contention. In their study, the subject's age group was 20 years to 29 years and 50 years to 89 years, they found a high frequency loss in the 50 years to 89 years age group. In the age group of 70 years and above moderate loss with slight involvement of low frequencies was observed and beyond 80 years an involvement of all frequencies was reported.

The study by Corso (1963) revealed the loss at 1000 Hz was found to be similar for men and women, but at frequencies above 1000 Hz, the males showed more loss compared to the females.

Hinchclife (1959) also found hearing of women of 18 years to 54 years of age to be better than those of the men, at frequencies 3000 Hz, 4000 Hz and 6000 Hz. In the older man, the difference was significant even at 2000 Hz, and 8000 Hz.

In the present study also the hearing for high frequencies was found to be slightly poorer in males compared to those of females.

The increase in hearing level with age was found to be more for high frequencies compared to low frequencies. In the present study, the increase inhearing threshold with age was about 25 dB at 250 Hz where as it was about 60 dB at 8000 Hz. Several studies along this line have reported similar findings. Glorig et al (1957) found a 3 dB increase in the median threshold at 500 Hz. In Corso's (1963) studies the increase in hearing level at 250 Hz and 8000 Hz was 2 dB and 10 dB respectively. The elevation of threshold with age at 250 Hz and 8000 Hz was greater in the present study.

Effect of sex:

The finding of difference in threshold between men and women generally support the finding of others. Specifically the finding that women have significantly better threshold than men at 2 KHz and higher is consistent with previously published report (Corso, 1963; Galli and Glorig, 1964; Glorig and Nixon, 1960; Lilienfeld and Lilienfeld, 1980; Moller, 1981; Rowland, 1981; Szanto and Ionescu 1983). Present study could not find any significant difference between men and women at lower frequencies does not support the suggestion made by some of the investigators (Corso, 1963; Harford and Dodds, 1982) that elderly men have better threshold at lower frequencies than to elderly women.

While other studies have found sex differences in hearing thresholds, only Corso, (1963) has shown that audiometric configuration also differ by sex. This findings with respect to sex differences in audiometric configuration are consistent with his result.

It is unlikely that differential noise exposure can be used to explain the sex difference found. There might be sex difference in noise exposure due to difference in sex role which this study was not designed to uncover, because men are more exposed to tear and shear of noise than women.

Corso (1963) and the results of the present study suggest that there is indeed real difference in the audiometric configuration of elderly man and women. Based on these data as on present study, it is interesting to note that while hearing threshold of men did not decrease systematically from age group to age group, there did seen to be a systematic decrease in hearing threshold from youngest to oldest age group of women.

Tone decay:

The findings of the present study is quite agreement to that of Zingers (1962) study. He failed to obtain any significant decay in men and women in the 8th, 9th and 10th decade of life. His conclusion was that degenerative changes in the cochlear and its neurons arenot dominant ractors in the development of prebycusis. Goetzinger (1961) has also failed to obtain any significant decay in eases with presbycusis. Possible explanation for individual variation in tone decay test could be applied to the degenerative changes taking place at various levels of the auditory system.

SUMMARY AND CONCLUSION

Present investigation was undertaken to study the age and sex variation if any in hearing by pure tone as well as tone decay among a group of subjects in the inmates of old age home. A sample of 50 subjects (25 males and 25 females) of age ranging from 50 years to 80 years were selected from the inmates of an old age home. The sample was categorized into three groups, 50 years to 60 years, 60 years to 70 years and 70 years to 80 years.

General history was taken to rule out middle ear pathology, ototoxicity noise exposure and other significant problem for each subject. Pure tone air conduction and bone conduction testing tone decay test and impedance audiometric testing was done in a room whose ambient noise level was measured using a sound level meter (B&K 2203) with associated microphone and filter set. Data was presented graphically and analyzed statistically.

Results obtained were as follows:

Sensitivity for pure tone decrease as age advances and frequency of hearing loss increases. The dependency of hearing acuity on frequency was most marked in older age groups as age increases. Variability was found to be more at high frequencies and in older age groups.

With respect to sex difference women were found to have significantly better threshold than men at 2 KHz but this study could not find any sex difference at lower frequencies.

Regarding tone decay results present investigation showed that findings are quite in agreement with those of other studies (Goetzinger, 1961, Punnan, 1976) who failed to obtain any significant decay. The conclusion was that the degenerative changes in the cochlea, and in the neurons are not dominant factors in the development of presbycusis and that degenerative change take place at various level of auditory system.

Conclusions are as follows:

1. There is a progressive reduction in sensitivity of hearing subjects as a function of age.
2. Geriatric population has greater prevelance of high frequency hearing loss.
3. Males and females have common age related change.
4. It is not possible to detect pathological changes at retrocochlear structure, if any, by tone decay test.

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APPENDIX-A

Name: Age: Sex:

Address: Education:

Occupation

1. EAR complaints:
   1) Hearing Loss :
   2) Earache :
   3) Ear discharge :
   4) Ear blockage :
   5) Tinnitus :
   6) Bleeding from ear :
   7) Other ear infection :

2. Do you have trouble communicating with your family because of your hearing problem?

a) Does your family make decisions for you because of your hearing problem?

b) Does your family get angry or annoyed with you because of your hearing problem?

c) How often does your family visit you?

d) How often do you visit your family?

3. Do you get upset when you cannot hear or understand what is being said?

a) Does your family know you get upset?

b) Do your friends know you get upset?

4. Do you think your family, your friends, and the staff understand what it is like to have a hearing problem?

a) Do they avoid you because of your hearing problem?

b) Do they hesitate to ask you to socialize with them?

5. Do you avoid communicating with other people because of your hearing problem?

a. Do you communicate with your roommate ?

b. Do you communicate during the social activities in the home?

c. Do you communicate with visiting family or friends?

6. Do you feel relaxed in group communicative situations?

a. Do you get nervous when you have to ask people to repeat what they have said if you have not understood them?

b. Do you watch facial expressions?

c. Do you watch gestures?

d. Do you have a hearing aid?

e. Do you wear your aid?

7. Do you think you need help in overcoming your heating problem?

a. Do you think this home provides adequate activities to make you want to communicate?

b. Can a person improve his communication ability by using lip-reading (or speechreading), which means watching the speaker's lips, facial expressions, and gestures when he's speaking to you?

APPENDIX - B

Name . . . . Age . . . . Sex . . . . . .

Tympanogram: . . . .

Right Left

Reflex	thresholds	250	500	1K	2K	4K
Right (phone)						
Left (phone)						

Pure tone (Air-conduction and bone-conduction)

Pure tone thresholds	250	500	1K	2K	4K	6K	8K
Right ear(A/C)							
Left ear (A/C)							
Right ear(B/C)							
Left ear (B/C)							

Tone decay test:

	500 HZ	1000 Hz	2000 Hz
Right ear			
Left ear			

APPENDIX-C

Procedure adopted for the calibration of the audiometer was as follows:

For the calibration of intensity the test earphone (TDH-39) of the audiometer was coupled with an artificial ear (B&K type 4152 with condenser microphone type B&K 4144). This system with preamplifier was then connected to a audio frequency analyzer (B&K 2107). The attenuator dial of audiometer was set to 70 dB HTL, then the out put of the audiometer was checked at each frequency from 250 Hz to 8000 Hz.

For checking linearity of the attenuator, the same set up for intensity calibration was used. Here at frequencies at 500 Hz, 1000 Hz and 4000 Hz attenuator dial reading was increased in 5 dB steps, and oncomitant SPL reading were noted. To ensure accuracy of the test frequencies, the out put earphone was fed to a frequency counter (Radart 203) maintaining intensity as a constant level.

The frequencies were sweeped from 250 Hz through 8000 Hz. The corresponding read out for each frequency was noted. The deviation were found to be within permissible limits. Distortion measurement were made and was found to be within permissible limits.

The frequency response of the earphones was also determined. The out put from beat frequency oscillator was given to the artificial ear (B&K 4152). The out put from test earphone (TDH-39) was given to an audio frequency analyzer (B&K 2107). The out put from analyzer was given to a level recorder (B&K 2305). As the beat frequency oscillator scanned through the frequency range from 20 Hz to 20 KHz the graphical recording of the frequency response of the ear phone was obtained.

APPENDIX - D

Ambient noise measurement:

Ambient noise in the test room was measured using a sound level meter (B&K 2209) with an half inch condenser microphone (B&K 4165) and octave filter set (B&K 1613).

The noise measurement were done at 'A' and 'C weighting net works,and at frequencies 250 Hz to 8000 Hz, at octave intervals.

Noise levels in dB (c) scale was 33 dB, the noise at each octave frequency has been given in table below:

Central frequency of the octave band in Hz.	SPL values inside the test room Ref. 0.0002 dyne/ cm^2	ISO (1964) specification SPL values in audiometric rooms. Ref.0.0002 dyne/ cm^2
250	24	25
500	20	26
1000	16	30
2000	18	38
4000	15	51
8000	15	56