Assessment of Hearing Loss Effects on Speech Difficulties by Speech Audiometry

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ABSTRACT

Background and objective: The basic audiological exam includes speech audiometry as a necessary component. The study aimed to assess the effects of hearing loss on speech difficulty in Kurdish populations in compared to a healthy control group. In addition, the study aimed to establish a Kurdish Speech Audiometry.

Material and Methods: The case-control study analyzed 100 patients, Divided into two groups 50 with hearing loss and 50 with normal hearing assessed by speech audiometry. The initial clinical interviews with the cases were conducted at Zakho General Hospital in Zakho city in the period from November 20th, 2021, to April 10th, 2022. Examination of the ear canal are performed as the first steps in a basic audiological evaluation, Pure Tone Audiometry and Speech Audiometry. All of the research's variables were covered by a questionnaire that was developed for the study.

Results: The comparisons of sound recognition between the patients for the right, left, and bilateral ears. There is a highly significant of the healthy controls compared with patients with hearing loss. Sound recognition threshold in the right ear, with 3 (25%) at 60dB, left ear 10 (83.33%) and bilateral ears 6 (15.79%) at 40dB in the patients. and 0 (0%) in the healthy controls.

Conclusion: The patients with hearing loss has significantly higher rates of speech difficulty compared to the healthy controls. The Lists of word can be used as a guide for identification of hearing loss to the Kurdish populations. Observed across the two monosyllabic and polysyllabic word lists. And the lack of differences between Speech Reception Thresholds (SRTs) and Pure Tone Audiometry (PTAs). Identifying the underlying causes and potential interventions for individuals experiencing hearing loss.

Keywords: Pure Tone Audiometry; Speech Audiometry Test; Hearing Loss; Sound Detection Threshold; Sound Recognition Threshold.

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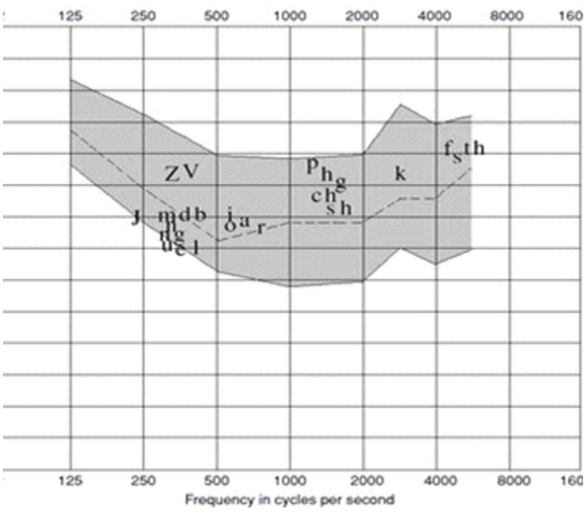
INTRODUCTION

Speech audiometry is an essential part of audiological diagnostics and clinical measurements [1]. Typically consists of determining the speech recognition threshold (SRT), the word recognition score (WRS) is established in quiet and, preferably, also in noise [2]. Speech is a particularly human tool for the expression of emotion, exchange of thoughts, and conveyance of information [3]. Humans require speech perception and comprehension in order to communicate normally. Many individuals with hearing loss say that they have difficulty understanding speech in everyday circumstances [4]. Speech audiometry is typically used to calculate the speech recognition threshold (SRT). Conducting listening trials, which frequently have the goal of determining the (SRT), are the gold standard for evaluating these algorithms. i.e., the signal-to-noise ratio (SNR) at which a particular proportion (often 50%) of words are identified. Speech audiometry tests were not introduced until the 1950s, and standardized test materials are still in short supply [3], [5]. The word recognition score (WRS) is the most crucial and widely utilized component of speech audiometry in current diagnostic audiology, word recognition testing is one of the most important procedures. When the words are delivered in a standardized context and the presentation level is at a suprathreshold level, it measures one's capacity to reliably recognize a list of spoken words (i.e., Pure tones are audible above the lowest feeling level) that is loud enough to provide the best results in terms of recognition [6]. Many additional languages, including Japanese, make use of the WRS., [7]. Turkish, [8] and Arabic. In the Egyptian press, word lists in Arabic have been reported, Iraqi, [9]. Saudi [10] , Jordanian, [11], and other studies. Previous Jordanian have found no significant variations in WRS in normal hearing Jordanians depending on ear or gender characteristics at the pleasant feeling level [12]. Regardless, the most used technique for measuring auditory perception is PTA due to the fact that it gauges a listener's openness to sound rather than their functioning hearing abilities, speech perception may not always be predicted with precision by pure tone audiometry [13]. Individual hearing qualities vary, and hearing is limited by age. Because hearing loss cases due to noise are on the rise, in addition to ear injury caused by electronic equipment and media development, noise induced deafness is steadily increasing among young college students [14].

METHODS

This is a case-control study, patients who underwent speech audiometry to evaluate the effects of hearing loss on speech difficulties were divided in to two groups study group and control group. The study group comprised patients diagnosed with hearing loss, while the control group consisted of individuals who were healthy, without any reported hearing complaints. The population of this study was the patients who were assessed with the effects of hearing loss on speech difficulties by speech audiometry at the Audiology center in Zakho city. The patients had different socio-demographic characteristics within Zakho City. The clinical center of Audiology / Speech Audiometry is the only tertiary specialized center for diagnostic and therapeutic services for Audiology / Speech Audiometry patients in Zakho City. In this case-control study, the patients who were assessed with the effects of hearing loss on speech difficulties by speech audiometry were included. The patients were then divided into two groups, the first one involved those who were diagnosed with hearing loss and the second group involved those who were healthy without any complaints or changes in their hearing were determined. Finally, the study included 100 individuals of both genders aged 18-30 years. The participants were divided into two groups: control group (CG), 50 healthy young adults with no hearing complaints or changes, and no systemic diseases; and study group (SG), 50 patients with a diagnosis of hearing loss, matched to the control group for age and gender. The CG was recruited through posters hanging on the walls of the Medical college and through invitations made to the persons accompanying the patients, while the SG subjects were recruited at the Educational Hospital & Private Hospital on the Kurdistan Region. The inclusion criteria state that individuals between the ages of 18-30 with normal hearing or any type of hearing loss can participate. However, individuals under 18 or over 30 years old, those with autism, and deaf and mute patients are excluded. The ethical approval of the current study was obtained from the Ethical Committee at the Duhok General Directorate of Health and the Scientific Committee of the Duhok College of Nursing formally approved the study proposal dated 24th – October - 2021 as a reference number: 24102021-10 -1 (Appendix A). To make it easier for researchers to do their investigation, a formal request for consent was prepared for Zakho General Hospital. Following the explanation of the study's goal for the students and patients, an oral verbal agreement form was collected from those who took part; they were given the option to cease or resume their participation at any time. They received a guarantee that all information would be kept confidential. Additionally, participation in this study was entirely optional, and participants were free to withdraw at any moment. After getting permission from the Duhok General Directorate of Health and the selected hospital administrations in Zakho City. The researcher collected the data through direct conversations with patients by using a pre-designed questionnaire. The information was taken from the patient's face-to-face interview technique. Additionally, the filling of the questionnaire for each patient took around 30–45 minutes. The patients have been informed that all data would be confidential and would only be used for research purposes Initial clinical interviews with all subjects were conducted at Zakho General Hospital. Examination of the ear canal are performed as the first steps in a basic audiological evaluation, Speech audiometry, pure tone audiometry (250-8000 Hz), and (speech recognition index (SRI) and speech reception threshold (SRT), likewise acoustic immittance techniques. The individuals wore headphones while undergoing speech audiometry. A clinician-diagnosed middle ear pathology was ruled out with immittance audiometry. All operations were performed with headphones, a free field audiometry amplification device, and an Inter Acoustics two-channel digital audiometer model, which were completed in an audiometric booth. Following the initial audiological examination, we used Kurdish Speech Audiometry (KSA) (Appendix E and F). The data collection process was handled by an audiologist with normal hearing. In the monitor room, a loudspeaker that was crystal clear allowed the audiologist to hear the participant's answer. If a participant properly repeated a word, the audiologist would put a checkmark next to it. The audiologist recorded the participant's incorrect words on the data collection form. The audiologist would put an X on the information gathering form if the patient was unable to say it again and made no response. Each participant's pure tone audiometry (PTA) rounded to the nearest 5 dB HL, was computed at 0.5, 1, 2, 4, and 8 kHz. Each word list's PI functions throughout all topic areas was created using the WRSs recorded from -10 to 55 dB SL (PTA) in 5 dB increments. The data collection and follow-up for this study took place over a span of six months, from November 20th, 2021, to April 10th, 2022. The overall study period extended from October 24th, 2021, to August 4th, 2023. Based on the plot of Swedish speech banana as shown in (figure 2.1) the value at the local maximum of the power spectral density, as noticed, corresponds to each phoneme frequency. The difference between the intensity at the local maxima of power spectral density is what defines each phoneme's intensity specifically [15].

Figure 2.1: Frequency in cycles per second [15].



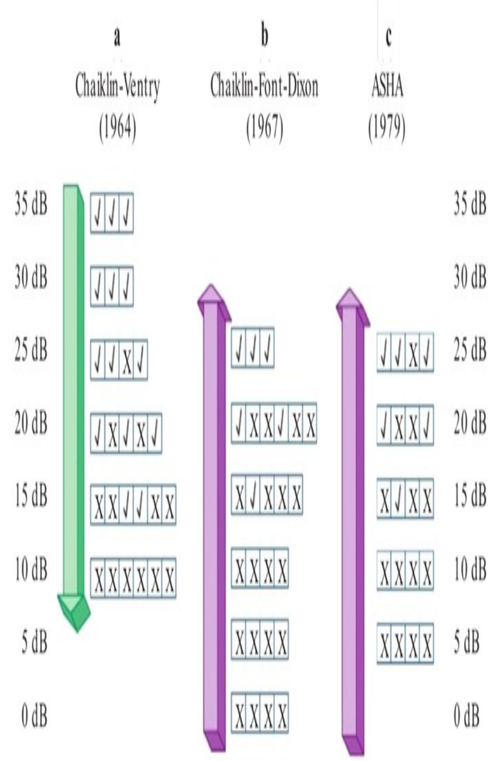
In this study the new words recognition lists created in Kurdish has a total of 2000 potential possibilities when all available combinations are used. We preliminarily construct a KST (Kurdish Speech Test) from 28 initial consonants, 22 vowels, and 3 tones. The remaining 196 words were created after absurd and improper terms were eliminated. A total of 96 words for the polysyllabic list and 100 words for the monosyllabic list were included in each of the two phonemically balanced lists. Due to their vocalic characteristics and classification as semivowels, the two glide consonants (i.e., (/ غ/were left out of the list of consonants. In order to diagnose and cure speech disorders, speech tests using phrase materials are performed, such as choosing the optimal amplification methods, as opposed to speech tests using word stimuli, which are designed for diagnostic purposes. Different consonants are represented by various Kurdish letters depending on their position in a word. Kurdish consonants are shown in (Table 2.1.). Kurdish also uses four more letters, including /) ژ)ʒ/), (/چtʃ/), (/گg/), and (/پp/). The Persian alphabet makes use of them, but the original Arabic letters do not have them. However, in rare instances, the two consonants are seen, which, for instance, has a consonant printed twice, (/وەڵاڵ Wałłał/, which stands “Swearing” in English.

Table 2.1.: Consonants in Kurdish

IPA	Sorani	Kurmanji	Word examples in Sorani	Examples of English words	Analysis
b	ب	b	(bał باڵwing)	b = "buy"	
p	پ	p	(pan پانwide)	p = "peek"	
t	ت	t	(taj تاجcrown)	t = "time"	
d	د	d	(dar دارtree)	d = "deer"	
k	ک	k	(koka کۆکهcough)	c = "cat"	
g	گ	g	(ga گاbull)	g = "green"	
q	ق	q	(qûł قووڵdeep)	English but sounds deeper in the throat in Similar to K	
ʔ	ا	'	(âzad ئازادfree)	"uh-oh" in middle sound	
f	ف	f	(fil فیلelephant)	f = "fire"	
v	ڤ	v	(vela ڤیلاvela)	v = "velocity"	
s	س	s	(sûr سوورred)	s = "spring"	
z	ز	z	(zirjan زریانhurricane)	z = "zinc"	
x	خ	kh	(khrap خراپbad)	German"Bach" in similar to ch	
ʕ	ع	`	(irâq عراقIraq)	pharyngeal (like Arabic "ain")	"The sound is conveyed in Arabic words; it is absent in Kurdish terms"
ɣ	غ	gh	(gaz غازgas)	Voiced but, similar to ع sound	normally pronounced [x]
ʃ	ش	sh	(shin شینblue)	sh = "shape"	
ʒ	ژ	zh	(zhyan ژیانlife)	ge = "garage"	
ʧ	چ	ch	(châk چاکgood)	ch = "chicken"	
ʤ	ج	j	(jwân جوانbeautiful)	j = "juice"	
ħ	ح	ḥ	(hoshtr حوشترcamel)	more guttural than the English h	Depending on the area, used frequently in Iraqi dialects
h	ه	h	(hiwa هیواhope)	h = "hole"	
m	م	m	(mâr مارsnake)	m = "mine"	
n	ن	n	(nân نانbread)	n = "north"	
w	و	w	(wiłât وڵاتcountry)	w = "wave"	
j	ی	y	(yusif یوسفjosef)	y = "yard"	
ɾ	ر	r	(firyad فریادrescuer)	r = "lord"	
r	ڕ	ř, rr	(řewi ڕێویfox)	Like Spanish trilled r	
l	ل	l	(lew لێوlip)	(front of the mouth l = "light"	
ɫ	ڵ	ł	(sâł) ساڵyear)	(back of the mouth l = "all"	

After determining hearing thresholds through calculating pure tone average (PTA) from air conduction thresholds at 0.5, 1 and 2 KHz by pure-tone audiometer, determine WRS monaurally in the better ear at several intensities through speech audiometer (Path medical GmbH Germany) by using monosyllable words lists through monitored live voice (MLV) with the microphone at a distance of about 15cm distance from the tester's lips which are covered by paper or mask to avoid lip-reading. The typical VU meter has a range that goes from –20 dB to +10 dB relative to the calibration point at 0 dB. Later, count the number of words that are correctly identified and convert to the percentage of the number of words presented (whole word score).Each group is tested by one half list at different intensity levels beginning at a speech level of 10 dB and increasing this level step-wise by an intensity of 10 dB until 60 dB when the subject reached maximum score in order to obtain the performance-intensity function and to assess internist intelligibility differences. It is generally accepted that the SRT is the lowest hearing level at which a patient can repeat 50%of spondee words, but there are many ways to nd this point and no single technique is universally accepted. Most SRT testing methods share several common features even though their specie c characteristics can vary widely. The most common characteristic is that several spondee words are presented to the patient one at a time at the same hearing level. The descending methods begin presenting these blocks of test words above the estimated SRT so that the patient is initially able to repeat them, and then press- ent subsequent blocks of spondee words at progress-snively lower hearing levels. This process is repeated until the patient misses a certain number of words; at which time the descending run is over. On the other hand, ascending methods start below the estimated threshold, where the patient cannot repeat the words, and then present subsequent blocks of test words at progressively higher hearing levels. This procedure is repeated until the patient correctly repeats a certain number of words, at which point the ascending run is terminated as show in (Figure 2.2.)

Figure 2. 2 :Examples of measuring the SRT with (a) descending [16], (b) ascending [17], and (c) ascending (ASHA1979) methods.



The general information of the patients and healthy controls were presented in mean (SD) or number (%). Hearing issues of patients with hearing loss and healthy controls were presented in number and percentage. Comparisons of degree of hearing loss between patients and controls were examined in an independent t-test. The significant level of difference was examined with a p-value of less than 0.05. The statistical calculations were performed in JMP pro 14.3.0 (JMP®, Version 14.3.0. SAS Institute Inc., Cary, NC, 1989–2023.) There are some limitations which faced the investigator during the period of study, some participant gets dizziness and vertigo during test.

RESULTS

Participants who provided their consent completed the questionnaire, which typically took approximately 45 minutes to finish. The study ensured strict confidentiality and the data collected will be solely utilized for research purposes. The average age of participants in the study group was 23.34 years (4.76%), while in the control group, it was 20.20 years (1.12%). Among the sample population, approximately 66% of the study group and 52% of the control group were male, whereas 34% of the study group and 48% of the control group were female.

Table 5. 1: Demographic characteristics between the patient and healthy controls

Demographic characteristics	Patient (n=50)	Health controls (n=50)
Age Mean (SD)	33 (66)	23.34 (4.76)
	17 (34)	20.20 (1.12)
Gender no (%)		
Male	33 (66)	26 (52)
Female	17 (34)	24 (48)

Table 5.2 presents the correlation between the patients with hearing loss and healthy controls regarding hearing loss in the right, left, and bilateral ears, as well as the types and duration of the problem. There is a lower significant of the healthy controls in terms of right ear SNHL 0 (0%) compared to the patients 22 (44%), as well as CHL with 5 (10%) in the patient and 0 (0%) in the healthy controls, and Mixed HL there is a highly significant in left ear. Additionally, there is a highly significant in the duration of the problem between the patient and healthy controls, specifically for durations of 01-11 months ago 24 (48%) for the patient, and durations of 5 years is 11 (22%) for the patient compared to healthy controls 0(0%).

Table 5. 2: Comparisons of types and duration of hearing loss between patient and healthy controls

	No (%)	
Hearing loss	**Patients (n=50)**	**Healthy controls (n=50)**
Hearing problem of right ear		
Normal	22 (44)	50 (100)
SNHL	22 (44)	0 (0)
CHL	5 (10)	0 (0)
MHL	1 (2)	0 (0)
Hearing problem of left ear		
Normal	7 (14)	50 (100)
SNHL	34 (68)	0 (0)
CHL	2 (4)	0 (0)
MHL	7 (14)	0 (0)
Hearing problem of bilateral ears	0 (0)	50 (100)
Normal	19	0 (0)
SNHL	(82.61)	0 (0)
CHL	2 (8.70)	0 (0)
MHL	2 (8.70)	
Duration of hearing problem		
No Problem	0 (0)	50 (100)
1-3 weeks ago	3 (6)	0 (0)
1-11 months ago	24 (48)	0 (0)
1-5 years ago	12 (24)	0 (0)
5 years and over	11 (22)	0 (0)

Table 5.3 and in figure 4.1 shows the comparisons of speech issue sound detection thresholds between the patient and healthy controls for the right, left, and bilateral ears. It is a significantly high of the study compared with healthy controls in the right ear sound detection threshold (SD = 82.06 (15.83) patient and (SD = 96.8 (3.35) detection threshold (SD = 82.58 (14.73) patient compared with (SD = 97.6 (2.19) healthy controls. Additionally, there is a significant difference in the bilateral ears' sound detection threshold (SD = 97.47 (5.20) patient and (SD = 99.91 (0.60) healthy controls. healthy controls. Similarly, there is a widely significant in the left ear sound

Table 5. 3: Comparisons of Sound Detection Threshold between patient and healthy controls

Speech issue	Mean (SD) Patient (n=50)	Health controls (n=50)
Sound Detection Threshold Rt ear	82.06 (15.83)	96.8 (3.35)
Sound Detection Threshold Lt ear	82.58 (14.73)	97.6 (2.19)
Sound Detection Threshold Bilateral ears	97.47 (5.20)	99.91 (0.60)

Figure 5. 1: Sound Detection Threshold between patients with hearing loss and healthy controls

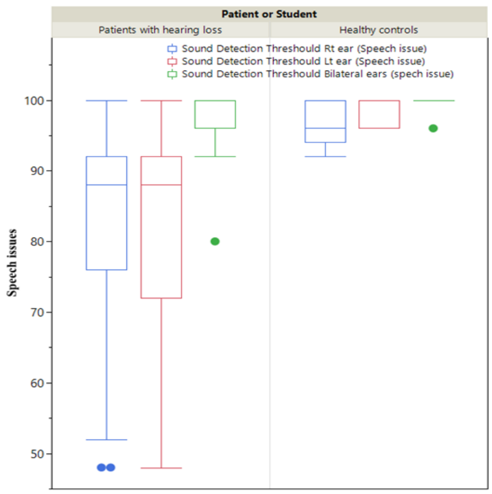


Table 5.4 Show that there is a strongly significant of the patient with hearing loss in term of sound detection threshold in right ear of detected threshold about 31 (62%) for patient compared to the healthy control 5 (10%). And also, there is a significantly high of the patient in left ear sound detection threshold for not detected threshold is 19 (38%) compared to the healthy control 45 (90%). While there is a lower significant of the healthy control in Bilateral ears sound detection threshold about 45% detection and 5% not detected threshold compared to the patient with hearing loss as show in.

Table 5. 4: Detection of sound between patients and healthy controls

Speech issue	No (%) Patients (n=50)	Health controls (n=50)
Sound Detection Threshold Rt ear		
Detected	31 (62.00)	5 (10.00)
Not-detected	19 (38.00)	45 (90.00)
Sound Detection Threshold Lt ear		
Detected	31 (62.00)	5 (10.00)
Not-detected	19 (38.00)	45 (90.00)
Sound Detection Threshold Bilateral ears		
Detected	19 (38.00)	45 (90.00)
Not-detected	31 (62.00)	5 (10.00)

Table 5.5 shows the comparisons of sound recognition between the patients for the right, left, and bilateral ears. There is a lower significant of the healthy controls compared with patients with hearing loss in the right ear sound recognition threshold, with 3 (25%) in the patients and 0 (0%) in the healthy controls at 60dB. Similarly, there is a strongly significant in the left ear sound recognition threshold, with 10 (83.33%) in the patients and 0 (0%) in the healthy controls at 40dB. Additionally, there is a highly significant in the bilateral ears' sound recognition threshold, with 6 (15.79%) in the patients and 0 (0%) in the healthy controls at 40dB.

Table 5. 5: comparisons of Sound Recognition between patient and healthy controls

Sound recognition	No (%)	
	Patient (n=50)	Healthy controls (n=50)
Sound Recognition Threshold Rt ear		
20dB	7 (58.33)	0 (0)
40dB	2 (16.67)	0 (0)
60dB	3 (25)	0 (0)
Sound Recognition Threshold Lt ear		
20dB	2 (16.67)	0 (0)
40dB	10 (83.33)	0 (0)
Sound Recognition Threshold Bilateral ears		
20dB		
30dB	25 (65.79)	50 (100)
40dB	3 (7.89)	0 (0)
60dB	6 (15.79)	0 (0)
85dB	3 (7.89)	0 (0)
	1 (2.63)	0 (0)

Discussion

The main findings of this study show that there is a higher significant difference in patient compared to the healthy controls in the sound detection threshold for speech issues in the right, left, and bilateral ears, as well as in sound recognition for bilateral ears. Additionally, there is a higher significant difference in hearing loss for the right and left ears. Factors strongly associated with the patient group compared to healthy controls include age, male gender, and hearing problems in the right ear, left ear, and bilateral ears. Furthermore, there is a strongly significant in the duration of the hearing problem, specifically about 01-11 months ago. Based on the results presented in this study, there are highly significant differences observed between the patient and healthy controls in terms of sound recognition thresholds and hearing loss. These differences could be attributed to various factors such as underlying medical conditions, exposure to loud noise, or other individual characteristics. In agreement with the previous study, the current study, the average age in the patient with hearing loss was 23.34 years (4.76%), and in the healthy controls, it was 20.20 years (1.12%). Approximately 66% of the patient and 52% of the healthy controls were male, while 34% of the patient and 48% of the healthy controls were female. And in the [11] patient indicating that there were no differences in performance between male and female participants in the study. The previous study included 15 healthy controls (2 males, 13 females, age 33-66 years, median age 51 years) and 15 patient

(4 males, 11 females, age 34-72 years, median age 52 years) participants in the NH group showed an average score of 58% (SD = 4.3), while the average score for the HI group was 59% (SD = 3.8), a Levene's Test for Equality of Variances showed no significant difference in variance (p = 0.405) and a two-sided independent samples t-test for Equality of Means showed no significant difference in means (p = 0.334) between groups [18]. Recent studies have supported current findings indicating that there is a lower significant of the healthy controls in terms of right ear CHL with 5 (10%) in the patient and 0 (0%) in the healthy controls. In privies study show that the participant with CHL had significantly lower correct responses than individuals with normal hearing for both sides. The results suggest reduced auditory temporal processing ability in adults with CHL compared to normal hearing subjects. Therefore, developing a clinical protocol to evaluate auditory temporal processing in this population is recommended [19]. In contrast to the findings of this study shows the comparisons of sound recognition between the patient for the right, left, and bilateral ears. there is a significant difference in the left ear sound recognition threshold, with 10 (83.33%) in the patients and 0 (0%) in the healthy controls at 40dB. Additionally, there is a significant difference in the bilateral ears sound recognition threshold, with 6 (15.79%) in the patients and 0 (0%) in the healthy controls at 40dB. In the [20] study shows that at 40 dB SL (above the SRT) level, normal hearing subjects attained maximum speech identification scores when compared to hearing impaired subjects using both word lists and was statistically significant (p = 0.001). Hence, it can be concluded that there is a significant difference in the performance of individuals with normal hearing and those with hearing impairment. Suggested that the word lists need to be tested on the population for which the test is intended in order to establish a more accurate test. Similar to the current study, in Bansal et al., 2016 study, out of cases, (44.55%) had SNHL (bilateral [67.95%]; unilateral [32.04%]) which was the most common type of hearing impairment among patients complaining of HL. This study had incidence of pure USNHL in 19.32% cases of SNHL, which is higher than other studies. The higher incidence may be because of difference between the total populations being considered. While in the current study out of cases 50% had SNHL (bilateral – [19 (82.61%)]; unilateral – [34 (68%)] there is a highly significant difference between the study and control groups. In line with the previous study, the [21] study’s shows that the word recognition scores in English were significantly lower than the word recognition scores in Cantonese for both the normal-hearing (p < 0.0001) and hearing-impaired groups (p < 0.0001). On the other hand, while the English scores of the hearing-impaired group are significantly lower than those of the normal-hearing group (p = 0.003), there was no significant difference between the groups when tested in Cantonese (p = 0.19). In other words, the effect of hearing impairment was greater when tested in the second language than in the native language. But in current studies shows the comparisons of word recognition scores in Kurdish sound detection thresholds between the patient and healthy controls for the right, left, and bilateral ears. There is a highly significant difference between the patient and healthy controls in the right ear sound detection threshold (Patient SD = 82.06 (15.83) and (health controls SD = 96.8 (3.35). Similarly, there is a high significant difference in the left ear sound detection threshold (Patient SD = 82.58(14.73) and

(health controls SD = 97.6(2.19). Additionally, there is a significantly high difference in the bilateral ear's sound detection threshold (Patient SD = 97.47(5.20) and (health controls SD = 99.91(0.60). Previously published studies [22] show the differences in detection or recognition between the categories is highly significant. Is to ensure participants are presented with at least one, preferably two or more, sounds from each category. This will result in more useful data from an equal number of participants. While the current study shows that there is a highly significant in the sound recognition threshold in the patient compared to the healthy controls at 40dB. As in this study, other literature has confirmed that these measures were also significantly correlated to high-frequency hearing loss ($p < 0.001$, $p = 0.031$, $p = 0.010$). SRT and spatial advantage were also significantly correlated to low-frequency hearing loss ($p < 0.001$, $p = 0.009$). However, SRT was significantly correlated with both low-frequency hearing loss ($p = 0.007$) and high-frequency hearing loss ($p = 0.012$). Talker advantage, which is a measure of the benefit gained from access to pitch cues, was significantly correlated with high-frequency hearing loss ($p = 0.003$). Alternatively, it could be argued that the absence of an age effect in this study is because of the different materials and maskers used in the study design [23]. Quiet thresholds were found to vary between 16 and 41.5dB SPL and were not significantly correlated with age (R2 = 0.05, $p > 0.05$), although quiet speech thresholds were significantly correlated with the average pure-tone thresholds at the two ears. Correlations were stronger for the average of three low- to mid-frequency thresholds (5, 1, 2 kHz: R2 = 0.62, $p < 0.0001$) than for three mid- to high-frequency thresholds (1, 2, 4 kHz: R2 = 0.52, $p < 0.0001$) [24], Numerous studies revealed that the difference between normal hearing- and hearing-impaired listeners was significant [$p = 0.003$]. The apparent difference between the two groups is supported by a significant interaction between hearing status and "static" versus "illusion" stimulus condition [$p < 0.001$]. These findings are argued to be primarily the result of (a) a change in dynamic binaural sensitivity and (b) high-frequency hearing loss affecting the audibility of pinna cues [25]. The current study compares the ear hearing loss between the patient and healthy controls for both the right and left ears. There is a highly significant in the right ear SN hearing loss, with 22 (44%) in the patients and 0 (0%) in the healthy controls. Consistent with the privies study, two subjects presented with a bilateral mixed hearing loss, the other two with a unilateral mixed hearing loss all the implanted subjects reached an SRT value below 65 dB, indicating that, at conversation level in quiet, more than 50% of the words could be understood. For this reason, some problems at the interposed skin level can be foreseen, especially in those patients undergoing a retro auricular incision after multiple middle ear surgeries [26]. The current study shows that the Mixed HL there is a highly significant in bilateral and unilateral hearing loss. In contrast to the findings of the present study, [27] found no significant difference in the factors of duration between the two groups ($p = 0.624$) [27]. The possible reason for this non-significant difference may be attributed to emotional and functional dimensions in their study. However, in the current study, a highly significant difference was observed in the duration of the problem between the patient and healthy controls, specifically for durations of 01-11 months ago 24 (48%) for the patient, and durations of 5 years is 11 (22%) for the patient compared to healthy controls (0%).

Numerous studies revealed that Lunner, 2003 shows the correlations between hearing loss and speech reception were significant (r0.47- 0.49). As well as the [28], shows four of the correlations between speech test and reading span score were significant (r0.37-0.56). And [29] shows The visual text-reception threshold was significantly correlated with the auditory speech-reception thresholds in both static and modulated noise (r0.54-0.54). Which is often taken as a measure of working memory and predicts performance on a wide range of cognitive tasks. While the current study shows that there is a significant difference between hearing loss and speech recognition threshold.

CONCLUSION

This study showed that the patients with hearing loss has significantly higher rates of speech difficulty and other audio-related issues compared to the healthy controls. In addition, the study showed that the established guideline can be used as a guide for identification of hearing loss to the Kurdish populations. Based on the study, the current study has significant implications for the field as it contributes to improving audiological diagnostic and rehabilitation services in the Kurdistan Region/Iraq. By conducting thorough validation experiments, the authors propose that the developed Word Recognition Test lists can be universally applied across different countries, indicating their broad applicability in diverse cultural and linguistic contexts. Overall, the results suggest that the developed speech materials are suitable for clinical testing of speech audiometry in the specific population, as evidenced by the consistent performance observed across the two monosyllabic word lists and the lack of differences between Speech Reception Thresholds (SRTs) and Pure Tone Averages (PTAs). These findings highlight the importance of further research to identify the underlying causes and potential interventions for individuals experiencing hearing loss. Additionally, these results emphasize the need for regular hearing screenings and interventions to prevent and manage hearing impairments in the population. Further investigation and analysis are needed to determine the specific causes and implications of these findings.

Recommendation:

The created Kurdish speech test lists should be standardized in Kurdistan Region /Iraq, and depended on the Ministry of Health in Kurdistan Region /Iraq. Further research is needed to explore the relationship between hearing loss and speech difficulty and quality of life (That includes aspects related to physical, mental, social, and environment interactions. Providing this group of patients with counseling services in order to help them obtaining social and psychological adjustment.

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