

# Word Recognition Test for Iraqi-Speaking Adults

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## Abstract

**Objective:** to contribute in the development of speech audiometric test in Iraq by using Arabic-Iraqi dialect for measuring word recognition score (WRS).

**Methods:** sixty normal persons aged 40-65 years (30 males and 30 females) divided into six equal groups. After determining hearing thresholds (PTA) determine WRS, each list of 25 words to one group, monaurally in the better ear at several intensities through speech audiometer by using monosyllable Alusi's words lists through monitored live voice (MLV).

**Results:** the normal speech audiometric curves of word recognition test in this study are similar to the normal curves obtained with previous Arabic, European and American monosyllabic word lists in addition to no intelligibility differences between Alusi's monosyllable word half-lists.

**Conclusion:** this study suggests Alusi's monosyllable word lists can be used in Iraqi Arabic-speaking adults to determine WRS.

**Keywords:** Iraqi Arabic speech audiometry, WRS, PTA

## Introduction

Speech audiometry is considered as a standard audiologic evaluation because it includes a measure of person's ability to understand and process speech<sup>(1)</sup>. The clinical use of speech test is very important for several reasons.

First, it is used to measure speech reception threshold (SRT) which provide a check of validity for pure-tone test results.

Second, it is used to determine suprathreshold levels by word recognition score (WRS). Third, It is useful in differential diagnosis of site of lesion in the auditory system<sup>(2)</sup>.

Word recognition score (WRS) is an essential component of speech audiometry i.e. WRS testing determines one's ability to correctly perceive and repeat a list of words presented at a suprathreshold level. It is

the most common test for suprathreshold measurement in percent correct at a level (dB HL) relative to either the SRT or an average of puretone thresholds<sup>(3)</sup>. The purpose of WRS testing is to assess how well a person can understand speech in a quiet environment when the level of the speech is loud enough to obtain a maximum WRS (PBmax), which is performed approximately 30-40 dB above the level of the SRT, or at the client's most comfortable level. By using single-syllable words, which are phonetically or phonemically balanced lists of single-syllable words (consonant-vowel-consonant), called PB words. The PB word lists were constructed to approximate the frequency of occurrence for different speech sounds or phonemes based on their occurrence in the English language.

For example, if a patient has an SRT of 20 dB HL, the presentation level of the speech stimuli used for WRS would be approximately 55-60 dB HL<sup>(4)</sup>.

In 1948, Egan proposed six criteria for selecting words to formulate word lists for word recognition testing in English: (a) monosyllabic structured words, (b) equal average of difficulty among lists, (c) equal range of difficulty within lists, (d) equal phonetic composition among lists, (e) composition representative of spoken English, and (f) commonly used words <sup>(5)</sup>. Scoring is recorded as a percentage based on 25 (half list) or 50 (full list) words, at the discretion of the examiner. For example, if a list of 25 words is presented and the listener correctly repeats back 21 out of 25 words, a WRS Score of 84% would be recorded (4), to determine the degree of impairment as in table (1).

A common representation of word recognition test results is through a psychometric function as displayed

by an ogive or S-shaped curve.

This curve represents how an individual's hearing ability increases with an increased intensity level (6).

There are two ways to score the results for word recognition tests: One way is to count the number of words that are correctly identified and convert to the percentage of the number of words presented, called whole word score. The other way is to count the number of phonemes that are correctly identified, called phoneme score, where each phoneme (initial consonant, vowel, or final consonant) in each word is scored as an item, and converted to the percentage of the number of phonemes presented(7).

**Table(1). Commonly Used Categories to Generally Describe Results of WRS Testing <sup>(7)</sup>.**

WRS (% Correct)	Degree of Impairment	Word Recognition Ability
100–90 %	None	Excellent/normal
89 – 75 %	slight	Good
74 -60 %	Moderate	Fair
59 – 50 %	poor	Poor
Less than 50 %	Very poor	Very poor

There are very few speech tests available in Arabic for audiological assessment (Messouak, 1956; Alusi et al. 1974; Ashoor & Prochazka, 1982 <sup>(8,9,10)</sup>. These tests were developed for speakers of Maghrebin, Iraqi and Saudi Arabic. The major differences in the dialects and vocabularies make it difficult to generalise to other populations in the region <sup>(6)</sup>. The lack of speech tests and the increasing number of hearing impaired individuals in the Arab world do necessitate the development of clinical tools that are appropriate for each population(2).

Alusi et al(1974) produced the so called Pan-Arabic Speech Test, consisting of 150 monosyllabic Arabic words divided into 6 PB lists of 25 words each and meant to be understood throughout the Arabic-speaking world. This was the first phonetically balanced and therefore useful Arabic speech test; this is the teaching language in schools and universities in order to meet the

criteria and conditions of familiarity, homogeneity <sup>(9)</sup>. The criteria used to select the words in Alusi et al, 1974 based on the research done by Fry (1964) and Hirsh et al. (1952) as follows:

(1)Familiarity of the words that chosen to both educated and non-educated persons to make this test valid for the examination. The main sources of words were primary school books, daily newspapers and children's story books. Technical and scientific words were avoided. (2)Homogeneity with respect to intelligibility i.e. difficult words were excluded. <sup>(3)</sup> Similarity of words between literary and colloquial Arabic dialects. (4)Phonetically balancing (PB):the lists were PB in the sense that vowels and consonants appear with the same frequency <sup>(8,11,12)</sup>.

## Subjects and Method

This study was carried out at Al-Sader Medical City in Al-Najaf government through a period which extends from December 2019 to June 2020. It included sixty normal persons aged 40-65 years (30 males and 30 females) divided into six equal groups. 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 Alusi's words lists (9) 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) (7).

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 interlist intelligibility differences.

## Results

Sixty Individuals participated in this study. Pure tone thresholds average (PTA) indicated that all participants fit the criteria of a PTA of 15dB HL or better with a mean PTA of 12.5 dB HL (standard deviation = 1.85). The better ear was selected based on PTA. All subjects had healthy middle ear (normal tympanometry) and free of otological disorders..

Word recognition scores increased with the increase of intensity. Scores at the lowest intensity level of 10 dB HL ranged from 0 to 12% while scores at the highest intensity level of 60dB HL ranged from 92 to 100%.

Performance-intensity curves are shown for six monosyllabic word recognition half-lists are shown in Figures 1 to 6. Results of the regression analyses are show a positive correlation ( $R^2= 0.923$ ) between intensity level and WRS as in table 2 so that, the lists are fit for speech testing.

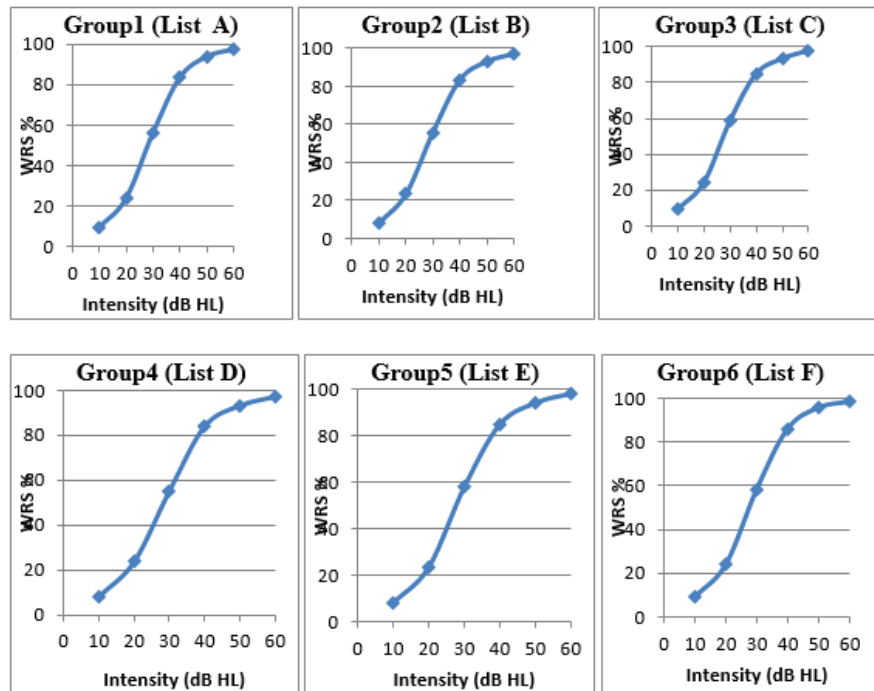


Figure 1. Average WRS in percent correct are compared across the six lists of monosyllabic word using different intensity levels.

**Table 2. Results of regression analyses for six monosyllabic word lists.**

<b>List</b>	<b>Correlation</b>	<b>Adjusted R<sup>2</sup></b>	<b>P</b>
A	0.966	0.933	< 0.005
B	0.964	0.929	< 0.005
C	0.963	0.925	<0.005
D	0.965	0.93	< 0.005
E	0.962	0.925	< 0.005
F	0.961	0.923	< 0.005

By using ANOVA to examine variability across the lists, there are no differences in performance between groups (lists) and within groups (gender) i.e. male and female individuals.

### Discussion

The purpose of this study is to contribute in development of WRS test since audiologic testing in Iraq now is depending on non-speech related audiometry as pure-tone audiometry. In this study, the improvement in individuals' performance as a function of intensity is consistent across the six lists(6,13,14). All had the same shape of curve and very similar 20%-80% slopes ( $\Delta y/\Delta x$ ) ( $\approx 3\%/dB$ ) and saturated at 50-60 dB SL. The Slopes of the psychometric functions when measured from 20 to 80% were slightly lower slopes (Mean $\approx 3\%/dB$ ), when compared to WRS of other languages, the mean slope of monosyllabic words in English were reported as 4.6%/dB for CID W-22 (15), 4.4%/dB (16), 3.6%/dB (17) for the NU-6 tests and 3.1%/dB (18). In a Mandarin study, the mean slope was 6.3%/dB for male recordings (19). While in Arab was reported as 3.5%/dB(2)

The differences in the slopes between languages may be due to differences in complexity across languages. These variations could range from a shallow slope of 1% per dB to as steep as 44% per dB (20).

### Recommendations:

- 1- In Iraq word recognition test must be used in audiological examination in addition to PTA test.
- 2- Test word recognition in noise.

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**Conflict of Interest:** None to declare.

**Ethical Clearance:** "All experimental protocols were approved and carried out in accordance with approved guidelines".

### References

- 1- Robertson, MC, Psychometrically equivalent Arabic monosyllabic word recognition materials. All Theses and dissertation. Brigham Young University BYU Scholars Archive. 2006; 743
- 2- Soha N Garadat, Khader J Abdulbaqi. The development of the University of Jordan word recognition test. International journal of audiology 2017; 56(6): 1-7.
- 3- Jack K , Marshall C, Kristina E. Handbook of clinical audiology. Seventh edition. chapter 5 speech audiometry. 2015.
- 4- Deborah R Welling , Carol A Ukstins. Fundamentals of audiology for the speech-language pathologist, 2<sup>nd</sup> edition, chapter 5 speech audiometry. 2019; 85-87.

- 5- Egan, J. Articulation testing methods. *Laryngoscope*, 1948; 58: 955-991.
- 6- Carhart, R. Basic principles of speech audiometry. *Acta Oto-Laryngologica*. 1951; 40: 62-71.
- 7- Steven K, David K. Brown . *Audiology : science to practice* ,third edition, San Diego, CA with contributions by James Jerger, H. Gustav Mueller. part 3 clinical audiology: chapter 8, speech audiometry. 2019; 161-163.
- 8- Messouak H. *Audiométrie vocale en arabe maghrébin*. Les Cahiers de la CFA, No. 4. (Paris : Compagnie française d'audiologie. 1956.
- 9- Alusi, H, Hinchcliffe, R. Arabic speech audiometry. *Audiology*. 1974; 13: 212-230.
- 10- Ashoor, A, Prochazka, T. Saudi Arabic speech audiometry. *Audiology*. 1982; 21: 493–508.
- 11- Fry, D. Modifications to speech audiometry. *International Audiology*. 1964; 3: 226-236.
- 12- Hirsh, I. J., Davis, H., Silverman, R., Reynolds, E. G., Eldert, E., & Benson, R. (1952). Development of materials for speech audiometry. *Journal of Speech and Hearing Disorders*, 17, 321-337.
- 13- Boothroyd, A. The performance/intensity function: An underused resource. *Ear Hear*. 2008; 29: 479–491.
- 14- McCreey, R, Ito, R, Spratford, M. Performance-intensity functions for normal-hearing adults and children using computer-aided speech perception assessment. *Ear Hear*. 2010; 31: 95–101
- 15- Beattie, R, Edgerton, B, Svihovec, D. A comparison of the Auditec of St. Louis cassette recordings of NU-6 and CID W-22 on normal-hearing population. *Journal of Speech and Hearing Disorders*. 1977; 42: 60-64.
- 16- Wilson, R, Oyler, A. Psychometric function for the CID-W22 and NU Auditory Test No.6. materials spoken by the same speaker. *Ear and Hearing*. 1997; 18: 430-433.
- 17- Wilson, R, Coley, K, Haenel, J, Browning, K. Northwestern University auditory test no. 6: Normative and comparative intelligibility functions. *J Am Audiol Soc*. 1976; 1: 221–228.
- 18- Heckendorf, A, Wiley, T, Wilson, R. Performance norms for the VA compact disc versions of CID W-22 (Hirsh) and PB-50 (Rush Hughes) word lists. *J Am Acad Audiol*. 1997; 8: 163–172.
- 19- Nissen, S, Harris, R, Jennings, L, Eggett, D, Buck, H. Psychometrically equivalent Mandarin bisyllabic speech discrimination material spoken by male and female talkers. *International Journal of Audiology*. 2005; 44: 379-390.
- 20- MacPherson, A, Akeroyd, M. Variations in the slope of the psychometric function for speech intelligibility: A systematic survey. *Trends Hear*. 2014; 18: 1–26.