

Arabic version of Acceptable Noise Level (ANL)

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Original Article

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ABSTRACT

Background: ANL is a procedure to evaluate the quantity of noise that listeners are willing to take over while listening to words. ANL has gained big attention in the final few years because of its ability to predict success rate of hearing aid with a high degree of accuracy. Knowing why certain people are less probable to accept background noise help in creating hearing aid technology to address their objections and improve their ANL hence increasing success rate of hearing aid function.

Objectives of the study: development and Standardization of Arabic version of ANL in Egyptian normal hearing listeners.

Materials and method: 52 normal hearing adults undergo this research. ANL was performed using an Arabic familiar story 40 Sec duration and competing background noise of multitalker babble. Both stimuli were routed through the same loudspeaker located at zero azimuth 1 m from the subject in a sound treated room.

The results: the mean ANL of the Arabic version in participant with normal hearing is 7.76 dB with a standard deviation of 3.55.

Conclusion: the new Arabic version of acceptable noise level (ANL) can be applied as a standardized test for measuring acceptable noise level.

Key Words: Acceptable noise level, arabic version, normal data.

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INTRODUCTION

Acceptable noise level (ANL) is the maximal sum of ground interference that a listener is willing to put up with while listening to running speech.^[1] Nábělek et al.^[2] introduced a routine to measure ANL by calculating the remainder between the most comfortable stage of speech (MCL) and ground noise level (BNL). Their results indicated that the ANL was directly linked to successful hearing aid function.

It is important to distinguish between spoken language understanding in noise and willing to listen in noise. ANL is not related to performance on a dissimilar type of language-in noise measure. The Speech-in-Noise test (SPIN) measures comprehension of sentences in noise (a complex linguistic process), while ANL measures willingness to allow background noise while taking heed to the quarrel

of a report (no linguistic process). Consequently, ANL and SPIN test each provide unique information about a patient's abilities.^[3] SPIN scores improve with amplification and can be applied as a criterion of benefit from amplification, but it, cannot anticipate who will be a successful user of hearing aids. The ANLs do not change with use of amplification and appear to forecast who will likely be proficient users of learning aids, even before they are fitted.^[4]

Knowing ANL may help those who fit hearing aids providing better counseling to people with hearing loss. Additionally, if we can see why certain people are less likely to be successful with hearing aids, and so we may be able to create technology that comes up to their objections to background noise and thus improves their prospects of success with hearing aids.^[1] Because of the above, we designed the work to modernize and standardize Arabic version of acceptable noise.

SUBJECTS AND METHOD

Subjects

This survey included 52 normal peripheral hearing adults with an age range of 18-50 years. The subject area was sanctioned by The Research Ethics Committee (approval code 30759/02).

Method

- Basic audiological evaluation: by Madsen Astera which is a Type-1two channel, and PC-based audiometer with with headphone TDH 39, Acoustic immittance measurements (tympanometry/stapedial reflex) by interacoustics AT235H impedance low frequency 226Hz probe tone (Middelfart, Denmark).

Speech audiometry including:

- a. Speech Recognition Threshold (SRT) using the Arabic bisyllabic word.
- b. Word Discrimination Score (WD) using Arabic phonetically balanced word.

- Acceptable noise level (ANL) test:

Acceptable noise level test material:

Speech stimulus: An Arabic story recorded by a female native speaker. The speaker is an Audiologist with professionally trained voice and she was understanding the purpose of the test. She was taught to preserve clarity, pace, and effort while learning the report. The narration is very coarse and well recognized in our Arab world (the rabbit and the turtle). It was recorded on Zoom H1 Handy Recorder which is a brilliant Stereo recorder. The recorded story was sampled as WAV to 24-bit/96KHz which used for high resolution recordings. Recordings were made in a double-walled sound treated room. An X/Y microphone designed to capture perfect stereo images with remarkable depth and clearness. The mike was positioned perpendicular to the loudspeaker at a distance of 1 m. Average signal levels at the microphone were maintained at about 65 - 70 dB SPL. The continuance of the story is about 40 Sec.

Background noise: competing background babble noise was a mix of 4 multitalkers. Speakers were one male and three females. Recording was done by the same procedure mentioned before.

ANL test procedure:

Both the speech stimulus and the competing background noise were routed through the audiometer to the same loudspeaker (MARTIN-AUDIO LONDON) located at zero azimuth 1 m from the subject in a sound treated room.

Determining the most comfortable level (MCL): the story runs at first and listeners were instructed to raise their hands when the story was uncomfortably loud, too soft and comfortable to them. Five dB steps were used for rough adjustment and two dB steps for fine fitting.

Setting the background noise level (BNL): the story run at MCL and background noise was added through the same speaker. Auditors were asked to put up their hands when story is incomprehensible, very well-defined and when they can trace the account without being tired from background interference. BNL was recorded.

ANL was calculated by subtracting BNL from MCL.

- Statistical Data were analyzed using the Statistical Program for Social Science (SPSS) version 21. Quantitative data were expressed as a mean \pm standard deviation (SD).
- Any unexpected complication that will come out during the course of the research will be cleared to the participants and to the ethical committee on time.
- Every participant will deliver a code number.
- The outcomes of the research will be applied only in scientific use.
- The idea of the research will be explained in details to the participants and also possible complications and side effect.
- An informed consent was obtained from all participants in this query.
- The participation is voluntary and that subject may discontinue participation at any time without penalty or loss of benefits.

RESULTS

It consisted of 52 adults 18 males (34.6%) and 34 females (65.4%). Their age ranged from 18-50 years. The mean age was 28.65 with a standard deviation of 6.43. They totally received a bilateral normal peripheral hearing in the frequency range of 250-8000Hz (hearing threshold level were \leq 25 dBHL). Mean and SD of PTA thresholds from 250 to 8000Hz was 13.13 \pm 5.49dBHL. Comparison of pure tone air conduction thresholds at different frequencies was done between right and left ears showed no statically significant difference.

III.a. Most comfortable level (MCL) and ground noise level (BNL)

The mean MCL was 50.96 dB HL with a standard deviation of 6.11. The mean BNL for the control group was 43.07 dB HL with a standard deviation of 6.26. Table (1).

Table (1): Mean, Standard deviation (SD), Range and confidence (95% CI).

	Mean	SD	Range	95%CI
ANL	7.76	3.55	0-16	6.79-8.72

III.b. Acceptable noise level results:

ANL was calculated by subtracting BNL from MCL ANL = MCL – BNL For the control group the ANL range was (0-16) The mean ANL was 7.76 dB with a standard deviation of 3.55. 95% confidence interval (CI) was 6.79-8.72. Table (1).

In parliamentary law to see the correlation between ANL and the other measures collected in this study, correlations between ANL, age and gender were calculated and no important association was set up between the ANL and age, hearing threshold level or gender (Table 2, 3).

Table (2): Correlation between ANL, pure tone average and age.

	ANL	
	R	P
Pure tone average	.659	.063
Age	.563	.082

Table (3): Relation between Sex and ANL.

Items	Male		Female		Test of sig.	p-value
	Mean	SD	Mean	SD		
ANL	7.67	2.84	9.17	5.0	t= 1.105	0.277

DISCUSSION

The objective of this work is to determine ANL in normal hearing using a new Arabic edition of the ANL test, the mean ANL for 52 adults with normal hearing

Sensitivity was 7.76 dB with a standard deviation of 3.55. Our outcomes were similar to previously reported results from English studies.^[2,5,6,7,8,9,10,11,12]

Participants evaluated by the Australian ANL test recorded a lower mean than reported in our and most other studies by about (5 – 6 dB), The ANL has a mean of 4.1 dB and a standard deviation of 5.5 dB. In the Australian study stimuli were presented idiotically through earphones. 13 In the current work, we used loudspeakers.

Chen et al. 14 used Chinese (Mandarin) language to evaluate the Mandarin speech signal content on the acceptable noise level (ANL) test in listeners with normal hearing in mainland China. Mean ANL was 7.6 with a standard deviation of 5.0. Their results are quite similar to this study 15

ANL has been studied using Danish and Swedish

materials. Mean ANLs between 5.6 and 16.6 dB respectively, and SDs between 6.9 dB and 10.2 dB respectively, depending on the study population (Danish or Swedish) and test condition^[14]

Possible grounds for varying effects from different fields are almost probable to be procedural or extrinsic in nature. In terms of procedure, the modality of delivery was variable among different subjects. In most studies speech and noise were either presented unilaterally through earphones, or bilaterally in the free field.^[13]

Harkrider and Smith 16 compared different modes of delivery and found a mean deviation of 2 dB between magnetic and dichotic presentation, defending the idea that different ways of delivery could influence the ANL.

This research results agreed with the immense bulk of studies which suggested that there is no relationship between ANL age, sex and hearing thresholds reported as the average pure-tone hearing thresholds^[2,3,6,8,16].

In summary, the new Arabic version of ANL can be used as standardized test for measuring acceptable noise level. The mean ANL of the Arabic version in participant with normal hearing is 7.76 dB with a standard deviation of 3.55. ANL was categorized into 3 groups low when ANL values were equal or less than 6 dB, high ANL when values were equal or more than 14 dB and mid group with ANL values between (6-14 dB). No correlation was found between ANL and age and gender.

We recommend Apply Arabic ANL to all patients with hearing loss for better counseling about benefits of hearing aid before fitting. Future researches on ANL in patients with sensory neural hearing loss and auditory neuropathy. We also recommended Applying ANL in children to identify children at risk of encountering listening problems at school.

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