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PRELIMINARY EVALUATION OF AN ECOLOGICALLY ADAPTED VERSION OF THE TURKISH HEARING-IN-NOISE TEST: NORMATIVE DATA FOR YOUNG ADULTS

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A Study design/planning
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C Data analysis/statistics
D Data interpretation
E Preparation of manuscript
F Literature analysis/search
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Abstract

Introduction: Recent research highlights the importance of ecological validity in speech-in-noise testing to better reflect real-world listening. In the original Hearing in Noise Test (HINT), speech-shaped noise is presented from one loudspeaker and target sentences from another. This preliminary study introduces an ecologically adapted Turkish HINT (Eco-HINT), which uses running-speech maskers and a three-speaker setup to create a more spatially complex and realistic listening environment. It establishes normative data for young adults with normal hearing.

Material and methods: Two text-based and two dialogue-based running-speech maskers were created from recordings of two voice actors (Masker Text and Masker Dialogue), at a 44.1 kHz sampling rate, recorded using Logic Pro for Mac. These recordings were edited, combined, and integrated into the HINT software. Target sentences were presented at 0°, with maskers at 100° and 260°. Some 42 normal-hearing Turkish adults (23 females, 19 males; aged 18–45 years) were tested with Eco-HINT. The Reception Threshold for Sentences at 50% accuracy (RTS50) and final signal-to-noise ratios (SNRs) were recorded. Descriptive statistics, sex comparisons, and test–retest reliability (intraclass correlation coefficient) were analysed.

Results: No significant sex-related differences were found in any test condition ($p > 0.05$). A percentile distribution is presented in which the 25th, 50th, 75th, and 95th percentile values for males are slightly better. Reliability was good for Masker Text SNR [dB], Masker Text RTS50 [dB], and Masker Dialogue SNR [dB] but lower for Masker Dialogue RTS50 [dB].

Conclusions: The Turkish Eco-HINT provides a promising alternative to the original Turkish HINT. The normative data obtained from young adults will serve as a foundation for future use. Our findings imply that in order to capture the complexity of daily listening challenges, ecological validity must be incorporated. The preliminary Turkish Eco-HINT suggests it can more realistically assess a listener's functional hearing performance in noisy environments.

Keywords: noise • adult • speech • normalization • Turkish Eco-HINT

WSTĘPNA OCENA EKOLOGICZNIE DOSTOSOWANEJ WERSJI *TURKISH HEARING IN NOISE TEST*: DANE NORMATYWNE DLA MŁODYCH DOROSŁYCH

Streszczenie

Wprowadzenie: Najnowsze badania podkreślają znaczenie ekologicznej trafności testów percepcji mowy w hałasie w celu lepszego odzwierciedlenia rzeczywistych warunków słyszenia. W oryginalnym *Turkish Hearing in Noise Test* (HINT) szum maskujący o widmie mowy jest odtwarzany z jednego głośnika, a docelowe zdania z drugiego. Niniejsze wstępne badanie przedstawia ekologicznie dostosowany turecki test HINT (Eco-HINT), który wykorzystuje do maskowania szum mowy i konfigurację trzech głośników w celu stworzenia środowiska słuchowego bardziej złożonego przestrzennie i bliższego rzeczywistemu. Badanie ustala także dane normatywne dla młodych osób dorosłych ze słuchem w normie.

Materiał i metody: Stworzono cztery rodzaje szumu maskującego z wykorzystaniem głosów dwóch osób: dwa oparte na tekście czytanym i dwa zapisy dialogów w (Masker Dialogue), z częstotliwością próbkowania 44,1 kHz, nagranych przy użyciu programu Logic Pro dla komputerów Mac. Nagrania te zostały zredagowane, połączone i zintegrowane z oprogramowaniem HINT. Zdania docelowe były prezentowane pod kątem 0°, a szum maskujący pod kątem 100° i 260°. Grupa badana złożona z 42 dorosłych Turków ze słuchem w normie (23 kobiety i 19 mężczyzn; w wieku 18–45 lat) została przebadana za pomocą Eco-HINT. Zarejestrowano próg rozumienia mowy przy 50-procentowej poprawności (RTS50) oraz końcowe stosunki sygnału do szumu (SNR). Przeanalizowano statystyki opisowe, wyniki w zależności od płci oraz rzetelność testu–retestu (współczynnik korelacji wewnątrzklasowej).

Wyniki: Nie stwierdzono istotnych różnic związanych z płcią w żadnym z warunków testowych ($p > 0,05$). Przedstawiono rozkład procentowy, w którym wartości 25., 50., 75. i 95. percentyla dla mężczyzn są nieco lepsze. Niezawodność okazała się dobra w przypadku Masker Text SNR [dB], Masker Text RTS50 [dB] i Masker Dialogue SNR [dB], ale niższa dla Masker Dialogue RTS50 [dB].

Wnioski: Turecki Eco-HINT stanowi obiecującą alternatywę dla oryginalnego tureckiego testu HINT. Dane normatywne uzyskane od młodych dorosłych posłużą jako podstawa dalszych badań. Nasze wyniki sugerują, że aby uchwycić złożoność codziennych wyzwań związanych ze słyszeniem, należy uwzględnić ekologiczne walidacje. Wstępne wyniki uzyskane dla tureckiego Eco-HINT sugerują, że może on trafniej oceniać funkcjonalną sprawność słuchu w hałaśliwym otoczeniu u osoby badanej.

Słowa kluczowe: hałas • osoba dorosła • mowa • normalizacja • turecki Eco-HINT

Introduction

As hearing technology continues to advance, the demand for hearing evaluations under conditions that simulate real life also increases. With growing awareness among clinicians and researchers in hearing science, efforts to address this issue are rapidly expanding. The Hearing in Noise Test (HINT) [1] is one of the most effective and widely used tools for evaluating hearing performance in noise under everyday listening conditions, and it has been adapted into many languages [2–10].

Although numerous studies have developed test environments or tasks simulating real-world conditions to evaluate hearing [11,12], the importance of updating these tests [13] and providing more ecologically valid versions has been increasingly discussed in recent decades [14]. In 2004, Neuhoff advocated the concept of "ecological psychoacoustics" and criticised traditional psychoacoustic testing methods for their limited focus on the auditory system's response without consideration of real-world parameters [15]. Following his discussion of the term "ecological validity", the concept has been used in hearing science to indicate that the test conditions should more realistically reflect everyday listening situations [16–18]. Within the framework of the World Health Organization's International Classification of Functioning, Disability and Health (WHO-ICF) [19], hearing researchers have increasingly emphasised the importance of assessing hearing-related functioning, activity, and participation in real-life contexts [20–23]. Although the concept of ecological validity may seem relatively new to hearing testing, it has long been recognised in psychology and related disciplines.

Motivated by this concept, hearing researchers have recently proposed an alternative procedure to standard Hearing in Noise Test application [24,25]. This alternative version introduces new noise signals and more effective presentation configurations [26–28]. By integrating a running-speech masker into the HINT system and presenting it through two spatially separated loudspeakers (100° and 260° azimuth), while the target speech is delivered from a third loudspeaker at 0°, these adaptations target a more realistic listening environment. Although the original HINT offers a standardised method for assessing speech understanding in noise, it employs speech-shaped noise presented from a fixed single direction. In contrast, the adapted version, by using running-speech maskers and multi-directional presentation of them (at 100° and 260°), represents an important step toward evaluating listening performance under more ecologically valid conditions.

In this study, we developed an ecologically adapted version of the Turkish HINT (Eco-HINT) by incorporating running speech maskers and naturalistic presentation positions. The specific term "Ecological HINT" is not yet established in the literature; we use the term to highlight its relevance to real-life rather than imply it is a formally standardised protocol. Accordingly, this study aims to develop a Turkish Eco-HINT and establish normative data for a sample of young adults with normal hearing sensitivity.

Material and methods

Participants

This study was conducted in the audiology laboratory of a private university. Ethics committee approval was obtained (date 24.10.2024, number 08/910). Volunteer participants were invited, and written consent was obtained from all of them.

A total of 42 participants (23 females, 19 males) aged 18–45 years were included. This specific age range was selected to provide a representative sample of the young adult population and to minimise the potential for age-related hearing effects. The sample size was determined using the G*Power (version 3.1.9.7) program prior to data collection. For an independent samples *t*-test, with an alpha level of 0.05, an effect size (Cohen's d) of 0.80, and a theoretical power ($1-\beta$) of 0.80, the minimum total sample size was calculated as 42 participants. Inclusion criteria were normal otoscopic findings, a bilateral pure-tone average (0.5–4 kHz) between −10 to 25 dB HL, and being a native Turkish speaker. Participants with a history of acoustic trauma, otological/neurological disorders, or difficulty in understanding speech in noise were excluded.

Turkish Eco-HINT software adaptation

Although the Eco-HINT software uses the same database as the original HINT software, it requires recorded and edited running-speech as noise. To generate this noise, speech samples from two voice actors were recorded using the Logic Pro for Mac program at a sampling rate of 44.1 kHz in a sound recording studio. Before recording, elementary school reading books were reviewed and several plain text passages (read in a neutral, narrative style) and dialogue passages (read in an interactive conversational style) were selected. The voice actors were instructed to read naturally, fluently, and clearly. Sentences that sounded unnatural or unclear were re-recorded. In total, four different speech samples (two plain text format and two dialogue format) were obtained, each approximately

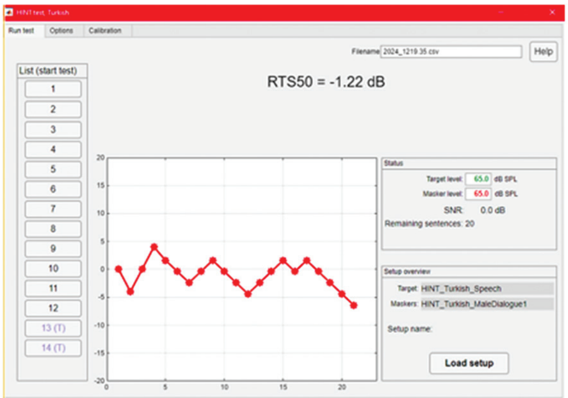

Figure 1. Software screen of Eco-HINT showing a Reception Threshold for Sentences (RTS) of –1.22 dB, the SNR at which the test person can correctly repeat 50% of the sentences

10 minutes long. The recordings were edited and integrated into HINT software in the Interacoustics Research Unit (IRU). The Eco-HINT screen is shown in **Figure 1**.

Both plain text-based and dialogue-based maskers were used to check if they yielded different results. The Reception Threshold for Sentences (RTS) refers to the SNR at which the test person can correctly repeat 50% of the sentences. Therefore, the RTS at the 50% sentence accuracy level (RTS50) can be measured based on the correct sentence score [4]. In the adaptive HINT procedure, the signal-to-noise ratio (SNR) is varied depending on the listener's responses. The final SNR refers to the average SNR of the sentences presented after the adaptive procedure has reached convergence.

Test conditions

A quiet room with no echo or reverberation was selected for testing. Unlike the original HINT applications, the Eco-HINT setup requires 3 high quality speakers. Therefore, as shown in **Figure 2**, three JBL One speakers were placed on three adjustable stands (Alctron model MS120). Each was positioned 1 m from the center of the participant's head with the height adjusted individually. The target sentences were presented from a loudspeaker positioned at 0° azimuth (front), while the two other loudspeakers playing maskers were positioned at 100° and 260° to simulate a more real-life listening situation [27,28]. The position of the participant is not changed during the test.

Figure 3 compares the spectral content of the original Turkish HINT test and the Turkish Eco-HINT. Both noise files were uploaded into ACS Audio Editor (version 11.1), and the Frequency Spectrum tool used for analysis. In the analysis window, the FFT size was set to 4096, the window type to Hanning, the vertical axis to dB, and the horizontal axis to frequency (Hz).

Data collection

Before starting the test, the speakers were calibrated with speech-shaped noise (SSN). The calibration level was maintained at a minimum of 70 dB SPL and a maximum of 90 dB SPL [29]. The software contained 12 lists (240 sentences). Each participant listened to one list of 20 sentences, presented randomly by the Eco-HINT system. A standard adaptive procedure was applied. The noise level was fixed at 65 dB SPL, while the starting level for target speech was 65 dB SPL. Participants were asked to repeat the sentences, and the tester marked the responses as "correct" or "incorrect". The step-size was 4 dB for the first four sentences, meaning that a correct response corresponded to a decrease in SNR of 4 dB, whereas an incorrect response meant there was a 4 dB better SNR for the next sentence. The step-size for the remaining sentences was set as 2 dB. Unlike the original HINT, participants were tested only in one condition (speech from the front, noise from both sides). All participants were tested under both masker types (text-based and dialogue-based),

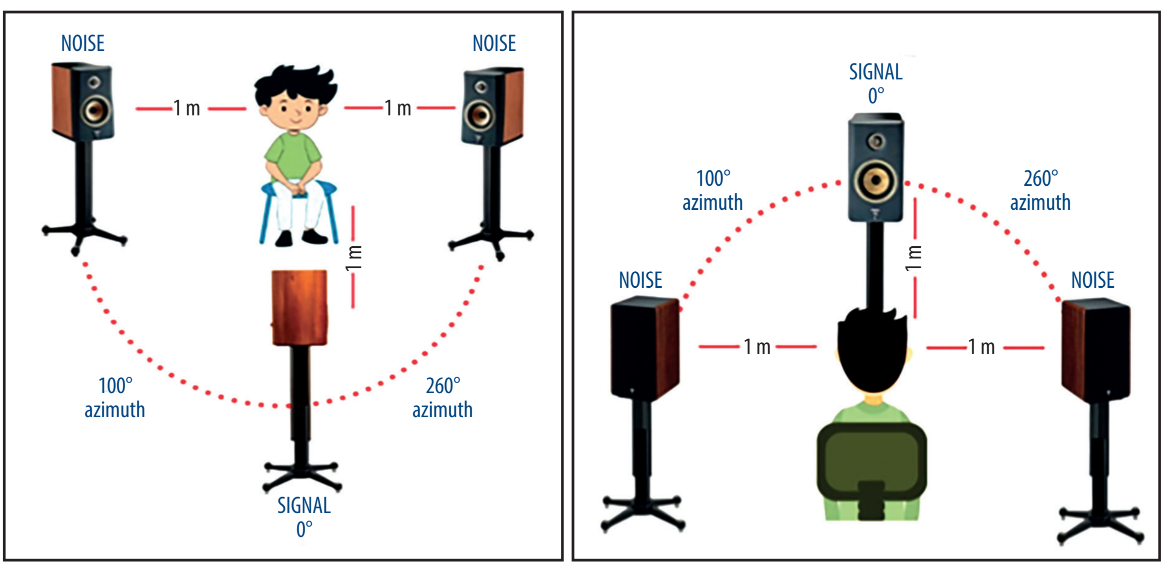

Figure 2. Front and back views of the Eco-HINT set-up

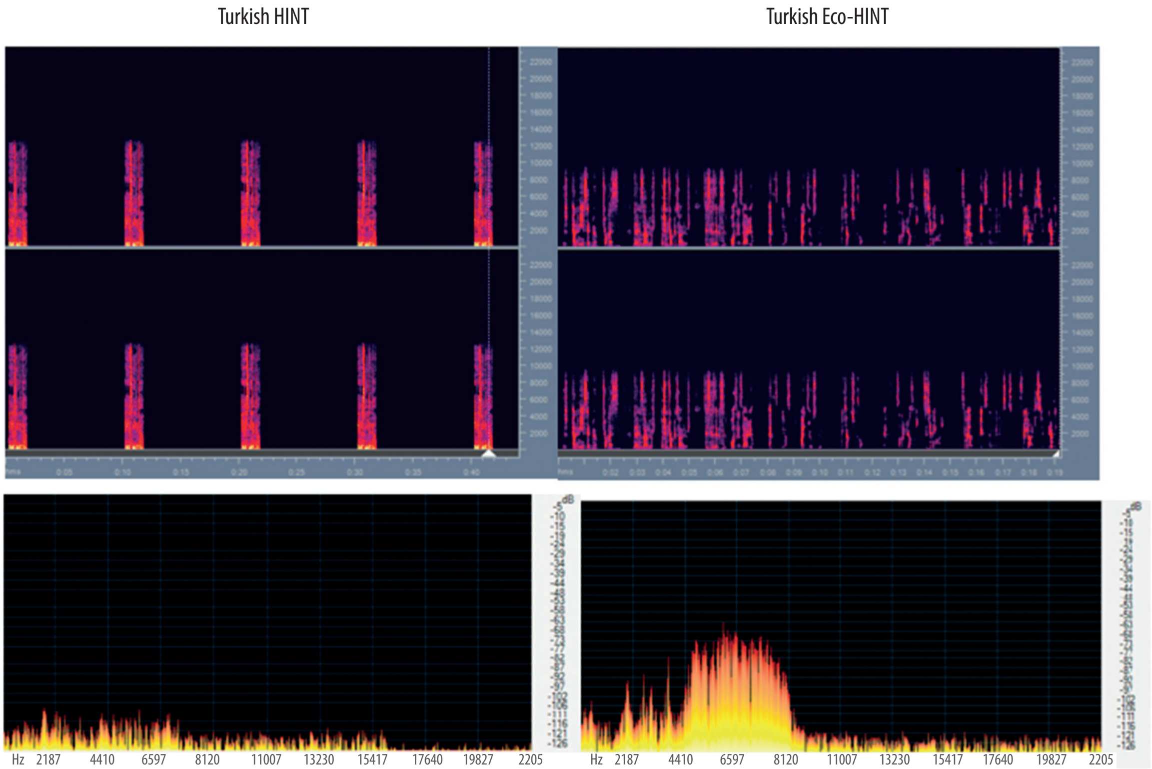

Figure 3. Sample spectra of the standard Turkish HINT test (left) and the Turkish Eco-HINT test (right). At top is a time–frequency plot and at bottom is an averaged spectrogram

Table 1. Descriptive values for all participants

All participants (*n* = 42)	Mean ± *SD*	Median (IQR)	Min–Max
Age [years]	30.7 ± 7.8	28 (26 – 39)	19 – 45
Masker (Text) SNR [dB]	–1.79 ± 3.03	–1.4 (–5.2 – 0.4)	–7.6 – 3.6
Masker (Text) RTS50 [dB]	–1.76 ± 2.71	–1.98 (–3.39 – –0.66)	–8.3 – 4.1
Masker (Dialogue) SNR [dB]	–0.99 ± 2.69	–1.2 (–2.8 – 1.2)	–8.4 – 4.4
Masker (Dialogue) RTS50 [dB]	–0.67 ± 2.8	–0.89 (–1.79 – 1.6)	–7.1 – 5.5

Note: *SD*, standard deviation; IQR, 25th – 75th percentiles

and the presentation order of the masker types was counterbalanced across participants. Short practice trials were provided before each condition. To evaluate the test–retest reliability, 15 participants (11 females, 4 males), were retested 1 week after the first session using the same setup and protokol. RTS50 and final SNR were recorded for each session.

Statistical analysis

The statistical analysis was conducted using SPSS (Statistical Package for the Social Sciences) version 25.0 for Windows. Descriptive statistics were calculated: number, percentage, minimum, maximum, mean, standard deviation, median, and interquartile range. Normality was assessed with kurtosis and skewness values. An independent sample *t*-test, and one-way analysis of variance (ANOVA) were performed, followed by Bonferroni adjustments. Pearson's correlation coefficient was applied to test the relationship between numerical variables. To assess test–retest reliability, an intraclass correlation coefficient (ICC) was calculated to determine the level of agreement between repeated measurements. Significance was set as $p < 0.05$.

Results

Descriptive statistics for all participants are shown in **Table 1** and a comparison of males and females is presented in **Table 2**. There was no significant age difference between males and females. The participants' ages ranged from 19 to 45 years, with a mean age of 30.7 ± 7.8 years and a median of 28 years. The mean age for females was 31.9 ± 7.8 years and for males 29.5 ± 7.8 years.

Table 2. Comparison of males and females

	Male ($n = 19$)		Female ($n = 23$)		p
	Mean ± *SD*	Median (IQR)	Mean ± *SD*	Med (IQR)	
Age [years]	29.5 ± 7.8	29 (22.3 – 38.8)	31.9 ± 7.8	28 (27 – 42)	0.392 ($z = –0.857$)
Masker (Text) SNR [dB]	–2.44 ± 3.17	–1.7 (–5.2 – 0.20)	–1.22 ± 2.85	–1.20 (–3.60 – 1.20)	0.190 ($t = –1.334$)
Masker (Text) RTS50 [dB]	–2.35 ± 2.38	–1.67 (–3.75 – –0.73)	–1.24 ± 2.91	–1.98 (–3.15 – 0.99)	0.183 ($t = –1.354$)
Masker (Dialogue) SNR [dB]	–1.64 ± 2.60	–1.60 (–2.8 – 0.20)	–0.43 ± 2.7	–0.40 (–1.2 – 1.2)	0.142 ($t = –1.497$)
Masker (Dialogue) RTS50 [dB]	–0.92 ± 2.88	–1.15 (–2.29 – 1.6)	–0.45 ± 2.77	–0.66 (–1.74 – 1.32)	0.586 ($t = –0.549$)

Note: *$p < 0.05$ statistically significant; *SD*, standard deviation; IQR, 25th – 75th percentiles; *t*, independent samples *t*-test; z, Mann–Whitney *U*-test

Table 3. Percentile distributions

		Percentiles												
		5	10	20	25	30	40	50	60	70	75	80	90	95
Masker (Text) SNR [dB]	All participants	–6.68	–5.88	–5.20	–5.20	–3.6	–2.0	–1.4	–0.88	0.24	0.40	1.20	2.48	3.44
	Male	–7.56	–6.74	–5.36	–5.20	–5.20	–3.92	–1.7	–1.28	–0.4	0.2	0.4	1.2	3.48
	Female	–6.0	–5.2	–3.92	–3.6	–2.80	–2.0	–1.2	–0.4	0.4	1.2	2.0	2.8	3.44
Masker (Text) RTS50 [dB]	All participants	–6.49	–5.31	–3.71	–3.39	–3.19	–2.58	–1.98	–1.14	–0.8	–0.66	–0.25	2.73	3.67
	Male	–8.26	–6.45	–3.87	–3.75	–3.36	–3.01	–1.67	–0.99	–0.8	–0.73	–0.48	–0.15	1.38
	Female	–5.83	–5.27	–3.49	–3.15	–2.75	–2.37	–1.98	–1.24	–0.76	0.99	2.64	3.62	4.02
Masker (Dialogue) SNR [dB]	All participants	–6.32	–4.4	–2.8	–2.8	–2.64	–1.2	–1.2	–0.4	0.4	1.2	1.2	2.8	2.8
	Male	–8.2	–4.4	–2.8	–2.8	–2.80	–2.8	–1.6	–1.2	–0.4	0.2	0.4	2.6	2.8
	Female	–6.32	–5.04	–2.32	–1.2	–1.20	–1.2	–0.4	0.72	1.2	1.2	1.84	2.8	4.08
Masker (Dialogue) RTS50 [dB]	All participants	–6.87	–4.36	–2.5	–1.79	–1.72	–1.24	–0.89	0.18	0.79	1.6	1.82	2.79	3.39
	Male	–7.1	–6.54	–2.63	–2.29	–1.79	–1.41	–1.15	–0.84	1.36	1.6	1.71	3.26	3.39
	Female	–6.37	–4.36	–2.18	–1.74	–1.63	–1.10	–0.66	0.56	0.73	1.32	2.22	2.79	4.99

Table 4. Test–retest reliability

	ICC	95% C.I. lower	95% C.I. upper
Masker (Text) SNR [dB]	0.815	0.45	0.938
Masker (Text) RTS50 [dB]	0.882	0.647	0.96
Masker (Dialogue) SNR [dB]	0.855	0.568	0.951
Masker (Dialogue) RTS50 [dB]	0.385	–0.832	0.794

Note: ICC, intraclass correlation coefficient; 95% C.I., 95% confidence interval

The four conditions presented in the tables are defined as follows. Masker (Text) SNR [dB] refers to the final SNR obtained under text-based condition. Masker (Text) RTS50 [dB] shows the RTS score for the SNR at which the test participant can correctly repeat 50% of the sentences under text-based condition. Masker (Dialogue) SNR [dB] refers to the final SNR obtained under dialogue-based condition. Masker (Dialogue) RTS50 [dB] shows the RTS score for the SNR at which the test participant can correctly repeat 50% of the sentences under dialogue-based conditions.

Mean (*SD*) and median (IQR) values are presented in **Table 2**. There were no significant differences between males and females under any of the conditions. The percentile distributions of the data is presented in **Table 3**. Overall, the 25th, 50th, 75th, and 95th percentiles values for males were slightly better.

Pearson correlation was applied to examine the relationship between Masker (Text) SNR and Masker (Text) RTS50 scores to confirm internal consistency between the two measurement outcomes. The analysis revealed a strong positive correlation ($r = 0.86$, $p < 0.001$), indicating that the participants who performed better (lower SNR) also had lower RTS50 values.

Test–retest reliability was checked with intraclass correlation coefficient and is presented in **Table 4**. Reliability was good for Masker (Text) SNR [dB], Masker (Text) RTS50 [dB], Masker (Dialogue) SNR [dB], but lower for Masker (Dialogue) RTS50 [dB].

Discussion

This study aimed to develop a Turkish Eco-HINT and to establish normative data for young adults by presenting percentile distributions. The results demonstrated high internal consistency across Eco-HINT measures, as indicated by the strong correlation between Masker (Text) SNR and Masker (Text) RTS50 ($r = 0.86$, $p < 0.001$). Overall, the Eco-HINT provided reliable estimates of speech-in-noise performance across most conditions; however, one condition showed a relatively lower ICC, suggesting that test–retest stability may vary depending on the specific listening condition.

Although sex comparison was not a primary objective, it was included to confirm the homogeneity of the normative dataset. No significant sex differences were found, indicating that the Eco-HINT normative results are applicable for both males and females. This finding aligns with previous studies reporting no sex-related variability in speech-in-noise performance when hearing sensitivity is within normal limits [30]. Similar to most previous normative HINT studies, the present study did not control for participants' educational or socioeconomic status. Although these factors are typically not considered in this type of research, they may still contribute to individual variability in speech-in-noise performance. Future studies are therefore encouraged to examine and control for these variables when feasible.

The term "ecological validity" is commonly used in psychoacoustics and audiology literature to denote a study's relevance to real-world hearing environments, often without formal statistical analysis [14,15,31]. From this perspective, the Eco-HINT offers a more ecologically valid approach than the original HINT, owing to two major design modifications. First, it employs running speech maskers, which better simulate real-world listening environments compared to speech-shaped noise. Second, it utilizes bilateral noise presentation via two loudspeakers positioned at 100° and 260°. In real-life communication, listeners naturally position themselves so that noise is behind and the speaker is in front. These spatial characteristics reflect natural listening conditions, where speech and competing sounds rarely come from a single fixed direction. This is the reason that such positioning was implemented in the Eco-HINT design. Consequently, Eco-HINT engages binaural mechanisms essential for understanding speech in realistic acoustic scenes [33,34].

When comparing the two different types of maskers, higher SNR values were obtained in the dialog-based masker than in the plain text-based condition, indicating that listeners found speech recognition more challenging when the masker was in a dialogue format. In contrast, the RTS50 values obtained under the dialogue-based masker showed slightly lower reliability, possibly due to the fluctuating and dynamic nature of conversational noise. These findings highlight that the linguistic and temporal characteristics of the masker – whether text-based or dialogue-based – can substantially influence both the difficulty and reliability in a speech-in-noise assessment.

Recent developments in hearing science emphasise the importance of test paradigms that simulate real-world acoustic scenes, leading to an increasing use of the term ecological validity in hearing research [31,34]. It has been argued that hearing aid fitting and auditory assessment should incorporate more ecologically valid measures, as they better represent real-life listening demands [35–38]. The Eco-HINT was designed with this perspective, combining realistic speech-like maskers and spatially distributed noise sources to reflect everyday auditory environments. Although the importance of evaluating hearing performance in noise is well recognised, hearing-in-noise tests are not routinely included in standard audiological test batteries [39]. One reason is that such tests are not easy to produce [1]. Additionally, the setup and pre-test adjustments can be challenging for practitioners. For instance, these tests are conducted in a free-field, requiring a sufficiently large room for loudspeaker placement. Although some centers have large acoustic booths, many others operate in small or acoustically treated rooms that may not meet full free-field standards. One limitation of this study is that measurements were conducted in a quiet room, rather than an acoustic booth. Therefore, quiet-condition measurements (threshold SRT) were not obtained. Another limitation is that noise loudspeakers were placed at 100° and 260° as suggested in previous studies. Alternative angular presentations or additional loudspeaker arrangements could also be explored in future work. While in real life people often position themselves with the speaker in front and noise behind, in some environments – such as factories – listeners are exposed to only directional noise. Although numerous studies exist on the original HINT in many languages, research focusing on ecological adaptation/validation remains scarce.

In this study, a Turkish Eco-HINT was prepared, which includes more realistic background noises reflecting daily life and suggests a new presentation position. Mean (SD), median (IQR), and percentage distribution of the data were presented. The mean and median SRT values were higher than –2 dB, which falls within but toward the higher end of the range reported for original HINT studies [40]. This means that Eco-HINT may impose a somewhat more challenging listening condition, potentially due to presentation positions and noise characteristics, compared to values typically reported in previous HINT normative studies. For reference, the article by Soli and Wong, which summarizes normative data across multiple studies, should be consulted [40].

As the number of studies on this subject increases in the literature, cross-study interpretation and comparison of findings will become increasingly feasible.

Conclusions

This study introduced the Turkish Eco-HINT, which is designed to better simulate real-world listening environments for testing hearing performance in noise. As normative data may only be valid for a specific group, the normative data obtained from young adult participants will serve as a foundation for future use. Our findings confirm that to capture the complexity of daily listening challenges, tests should have enhanced ecological validity. The Eco-HINT allows researchers alternative methods to assess a listener's functional hearing performance in noisy environments. Moreover, Eco-HINT may support decision-making in hearing aid verification and counseling by providing data that more closely reflect patients' real-life communication abilities. Future studies should further validate Eco-HINT and investigate applicability across different age groups and hearing impaired populations, as well as compare its outcomes with those of other ecologically valid measures. Continued studies of this topic will advance scientific understanding and the clinical management of hearing in complex auditory environments.

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Data Availability Statement

The data for this study can be provided upon request from the responsible author. The data is not publicly available due to confidentiality or ethical restrictions.

Conflict of interest statement

The authors have no conflict of interest.

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