

LEXICAL STRESS ACCURACY IN ENGLISH: AN ACOUSTIC STUDY OF URDU L1 LEARNERS WITH REFERENCE TO RP NORMS

Hamna Tayyab hamnatayyab23@gmail.com	Department of English, Division of Arts and Social Sciences, University of Education, Lahore 54770, Pakistan.
Dr. Humaira Irfan ac.engl.lmc@ue.edu.pk	Assistant Professor, Department of English, University of Education, Lower Mall campus, Lahore 54770, Pakistan.
Nayab Fatima nayabfatima1249@gmail.com	Department of English, Division of Arts and Social Sciences, University of Education, Lahore 54770, Pakistan.
Zoraiz Amin Ch zoraizshakir@gmail.com	Department of English, Division of Arts and Social Sciences, University of Education, Lahore 54770, Pakistan.
Tariq Javed tariqjavedsial113@gmail.com	Department of English, Division of Arts and Social Sciences, University of Education, Lahore 54770, Pakistan.

Abstract

Lexical stress is one of the most important suprasegmental features of phonetic and phonology. It plays a crucial role in pronunciation and intelligibility. In Pakistan, a considerable problem has been seen when learners exhibit stress on English words, particularly due to the influence of their L1. Many linguists investigate the influence of L1 on ESL learners. However, there is not significant research on how Urdu L1 speakers, who are further study Urdu at higher level, produce stress on English words. This study analyzes the production of lexical stress in English by Urdu L1 learners that is investigated with reference to Received Pronunciation (RP) norms. The accuracy of stress placement is inspected with its acoustic realization by using pitch(F0), intensity and duration. The sample was taken from seven Urdu L1 speakers from the Department of Urdu from the University of Education, Lahore, Pakistan. A number of 18 targeted words extracted from the recording of four sentences read by the participants. PRAAT, the phonetic and speech software was used to examine the data. The findings highlight that Urdu learners exhibit low to high accuracy in stress placement during pronunciation. Overall accuracy rate was 46.1%. Polysyllabic words were often mispronounced and an inclination is to shift stress towards the 2nd syllable of most words. Acoustic analysis showed that learners can produce stress by greater intensity, higher pitch and most of all by longer duration. The study concludes that learners are able to realize the lexical stress but they face difficulty in synchronizing with standard English RP norms.

Keywords: *Acoustic, Duration, Intensity, Lexical Stress, Pitch, PRAAT, RP Norms.*

Corresponding Author: Hamna Tayyab (Department of English, Division of Arts and Social Sciences, University of Education, Lahore 54770, Pakistan)
Email: hamnatayyab23@gmail.com

1. Introduction

Pronunciation constitutes one of the most important and frequently undertheorized dimensions of second language acquisition (SLA). Among the numerous phonological features that characterize native-like speech, lexical stress occupies a particularly central position. Lexical stress is a central feature of English phonology contributes significantly to lexical access, communicative competence and speech intelligibility. It refers to the relative prominence assigned to one or more syllables within a polysyllabic word through acoustic features such as intensity, duration and fundamental frequency (F0). Lexical stress helps in word recognition, disambiguates lexical items and signals information structure within discourse (Cutler, 2015). In English, lexical stress is contrastive and can alter both grammatical category and meaning, as illustrated in '*record*' (noun) versus '*record*' (verb), a noun-verb alternatives. (Roach, 2009). Lexical stress is essential especially in second language acquisition (Field, 2005; Derwing & Munro, 2015).

In the domain of second language acquisition (SLA), lexical stress has been widely acknowledged as a persistent challenge for ESL learners. A major factor contributing to this difficulty is first language (L1) transfer, whereby when producing the target language, learners rely on the phonological rules of their native language (Odlin, 1989). James Emil Flege's Speech Learning Model elaborates that L2 learners usually assimilate unfamiliar phonetic features into existing L1 categories, as a result systematic pronunciation errors occur (Flege, 1995). Similarly, Perceptual Assimilation Model by Catherine Best's suggests that non-native sounds are interpreted through the lens of L1 phonological categories. So, they affect both perception and production (Best & Tyler, 2007). Another study was conducted in 2009 on speakers of non-central languages which suggested that the participants were unable to compute material provided by researcher (Archibald J, 2009). These aforementioned theoretical perspectives highlight that there is a strong influence of L1 phonology on L2 stress production.

Urdu and English prosodic systems have different structural differences, due to this Urdu-speaking L1 learners highlighting the need for examining lexical stress acquisition. Urdu is an Indo-Aryan language and the national language of Pakistan. Urdu is a syllable-timed language with predictable stress patterns that are determined by morphological structure and syllable weight (Mahboob & Ahmar, 2004). Urdu has a less contrastive and less rigid stress patterns compared to English (Hussain, 1997). On the other hand, the stress placement in English language is variable and lexically determined. It entails its learners to acquire stress patterns on a word-by-word basis instead of long phrases (Roach, 2009).

The phonological stress difference between Urdu and English tends the Urdu speakers to apply same rules on English. These errors are not just at a surface level. Misplaced stress can alter perceived word boundaries. It can affect meaning and fluency of a speaker and can also compromise a speaker's professional credibility (Derwing &

Munro, 2015). This L1 influence on L2 learning results in overgeneralization of initial stress or incorrect placement in multisyllabic words during the learning of ESL (Riaz et al., 2023).

Within the Pakistani context, the study centers on segmental features of English lexical stress as a core component. The literature knowledge indicates that Pakistani ESL learners often misplace stress in disyllabic and polysyllabic words due to influence of L1. It is mainly due to insufficient exposure to native-like input and limited phonological training (Abbasi et al., 2018; Riaz et al., 2023). In some cases, learners are aware of stress placement in English but unable to apply it. It highlights the gap between production and perception (Duong, 2017). This gap urges the need for more detailed investigation into the acoustic realization of stress among Urdu-speaking learners.

The more precise and objective data can be done through acoustic tools such as PRAAT, developed by Paul Boersma and David Weenink. PRAAT software tool allows researchers to analyze key acoustic correlates of stress, including vowel duration, intensity and pitch (F0) (Boersma & Weenink, 2023). A reliable comparison between learner production and native benchmarks can be analyzed. Affective results with visual feedback are generated by PRAAT (Yaslam & Ganapathy, 2025).

1.1. Research Objectives

1. To analyze the acoustic realization of English lexical stress among Urdu L1 speaking learners by using pitch(F0), duration and intensity.
2. To identify stress patterns by Urdu L1 learners.
3. To compare learner stress realization with standard Received Pronunciation (RP) stress patterns as a reference.

1.2. Research Questions

1. How do Urdu-speaking learners acoustically realize English lexical stress?
2. How does learners' stress realization align with standard Received Pronunciation (RP) stress patterns?
3. What is the most common stress pattern followed by Urdu speaking L1 learners?

2. Literature Review

English is lexical stress language in which some syllables in a word are more prominent than others. English stress differs across different syllables depending on the word. Stress variation can also change /meaning (Culter, A. 2015) by changing grammatical categories of a word such as nouns and verbs (e.g. PREsent vs preSENT). Because of this reason correct placement of stress is important in clear and intelligible communication. The acoustic realization of stress requires multiple phonetic features including fundamental frequency (F0) (pitch), duration (length), intensity (loudness) and vowel quality. These features together help listeners identify which syllable of a word is

stressed. The study of lexical stress is important in understanding speech processing and improving pronunciation teaching.

2.1. Acoustic Correlates of Lexical Stress

Previous research has shown that lexical stress is not expressed by acoustic features but by a combination of cues. D. B. Fry (1958) explored that stress in English is not identified by only a single cue but through a combination, particularly duration and pitch. This study highlighted the multilayered nature of stress perception. As explained by Lehiste (1970), syllables with stress are normally characterized by: higher intensity, greater duration, full vowel quality and higher pitch (F0). Listening depends on a combination of duration, pitch and amplitude to identify syllables of stress (Zhang, et al, 2008).

The latter studies also employed computational methods to analyze prosodic features and word stress. Abbasi, A. M., & Husain, I. (2026) conducted computational techniques to analyze word stress in Sindhi and English. The study indicated that pitch in English and duration in Sindhi was more prominent. These results highlight the effectiveness of computational methods in exemplifying prosodic features and support the multidimensional nature of lexical stress.

2.2. Lexical Stress in Second Language Acquisition

Learning of lexical stress presents serious challenges for L2 learners especially when their first language (L1) has a distinct prosodic system. The study indicates that learners frequently show variances in both acoustic realization and stress placement. The evidence of distinct stress realization between L1 and L2 is given by Chung-yu Tseng, Su, and Visceglia (2013). The study explored how different levels of word stress; primary, secondary and tertiary are processed by L1 and L2 speakers. The results showed that native speakers produced strong and clearer contrasts between unstressed and stressed syllables. Although, L2 learners showed weaker levels.

How incorrect stress can change understanding was examined by John Field (2005). He shifted the focus to the listener and showed that listeners depend on correct stress patterns for recognition of words. His experimental study revealed that both non-native and native listeners had issues when stress was misplaced. Significantly, the results posed that intelligibility is not entirely determined by segmental precision but is strongly influenced by prosodic cues like lexical stress.

Stress in English language depends on multiple cues like pitch, duration and intensity while in other language like Japanese, especially, focuses on pitch only (Berline, 1986). Furthermore, Yu, et al. (2010) investigated cross-language perception of word stress in English among Chinese learners of English and native English speakers. The study found that both groups could perceive stress patterns, but they differed in their

reliance on acoustic cues and response patterns. The result indicated that language background influences how lexical stress is processed.

2.3. Cross Linguistic Influence (L1 transfer)

One of the main reasons for L2 stress error is L1 transfer. This means learners tend to use the prosodic features of their first language when speaking in a second language. For instance, Zhang et al. (2008) compare lexical stress correlation including frequency (F0), duration, intensity and vowel quality Mandarin speaker with English speakers. The result revealed that Mandarin speakers were less native like, especially due to greater reliance on pitch. These differences were due to the influence of Mandarin tonal features emphasizing the impact of L1 experience on L2 stress production.

Similarly, Guo, X. (2022) study examined how Chinese learners from different dialect backgrounds produce English lexical stress compare to native speakers. The experiment includes higher F0, duration and intensity for stressed syllables. The second language learners showed deviation due to L1 prosodic transfer. The speech learning model (SLM) proposed by Flege (1995) explained that second language speech is influenced by L1 phonetic systems. It suggests that learners perceive and produce L2 sounds based on their existing knowledge of L1 categories. It then explained that phonetic system remains adaptable across the lifespan that often results in non-native like production. This structure supports a theoretical foundation for understanding L2 stress production and non-native accent.

2.4. Stress Patterns in Urdu

Like English, Urdu also have different stress patterns that can produce difficulties for learners. The study on Urdu phonology demonstrates that stress plays a crucial role in speech processing and pronunciation. Mumtaz, B. el at. (2022) examined the role of stress in Urdu and established that stressed syllables are mostly marked by increase in duration. The study also revealed that stress interacts with intonation in complicated ways and stress perception is affected by weight of syllable. The results imply that duration is an important base for stress in Urdu.

Additionally, Hussain, S. (1997) establishes that stressed vowels have lower fundamental frequency (F0) and longer duration compared to unstressed vowels. The findings conveyed that quality of vowel changes with stress, as unstressed vowels go through more contextual effects. Features of consonants such closure voicing, duration and aspiration are also influenced, that showed stress influences both consonants and vowels in Urdu.

Hussain, S. (2005) observes that stress task is a main part of Urdu phonological processes particularly, in speech systems like text to speech. Backing his work Mehmood el at. (2017) explained that Urdu might have both primary and secondary stress, especially in longer words. This questions the earlier view of how Urdu has only one stress per word.

Furthermore, Ul Ain, et al (2023) concluded primary and secondary stress in Urdu language by analyzing trisyllabic words (three syllables in a word). The research found three levels of stress: primary, unstressed and secondary. Results revealed that vowel duration was the strongest indicator of stress whereas stressed syllable showed intensity but vowel quality changes with lower pitch (F0). The findings implied that stress in Urdu is mostly duration based and acoustically varies from patterns of English stress.

Khan, S. (2019) study investigated that Urdu speakers frequently face problems in producing correct English stress which leads to miscommunication and reduce intelligibility. It points out that stress is often neglected in instructions of language. Moreover, Farooq, M., & Mahmood, A. (2021) conducted the study acoustic effects of Urdu phonological rules on English speech produced by Pakistani Urdu speakers. The study analyzed phenomena such as segment alteration, emphasis and ellipsis. Its findings revealed that Urdu phonological rules affect stress pronunciation in English and stress placement. This study point outs the influence of L1 Urdu on L2 English stress pattern.

Additionally, Imtiaz, Z. et al (2024) explored the stress patterns among Urdu speaking learners of English in English department of UOK. They utilized recorded interviews and reading tasks to analyze how learners assign stress and segment words. The results showed a strong influence of Urdu on the English stress production and learners frequently deviated from target like patterns. The study indicates the complexity of learning English stress and underscores the role of L1 transfer in tailoring pronunciation. Similarly, research conducted by Abbasi et al(2025), on disyllabic nouns and verbs using acoustic cues by L1 multilingual speakers. The results showed that the participants were unable to differentiate between nouns and verbs stress pattern that mirrors variation in Pakistani English

To sum up, previous literature above has revealed different studies on lexical stress in English and its acquisition by L2 learners, most studies have focused on either stress perception, stress error placement or large-scale acoustic comparisons involving diverse language groups. The present study is different in this aspect as it aims to investigate how Urdu speaking L1 learners produce English lexical stress using a small scale. It focuses on measurable cues such as fundamental frequency (F0), duration and intensity rather than stress placement alone. This study aims to highlight how Urdu learners acoustically realize lexical stress in English by analyzing recorded sentence level speech.

3. Methodology

3.1. Research Design

This research endorses a quantitative descriptive research design to investigate the lexical stress accuracy of Urdu speaking L1 students. The investigation concentrates on both the placement of stress and its acoustic realization in the chosen English words.

An acoustic approach was used to analyze stress production through using such as pitch, duration and intensity. These stress patterns were compared with Received Pronunciation (RP) norms, which help as an excellence model for accurate stress position.

3.2. Participants

This research includes a group of seven Urdu-speaking L1 learners registered in BS Urdu course. Every contributor had Urdu as their first language (L1) and were acquiring Urdu as an additional lingo. All participants have same educational background and have never acquired the knowledge of phonetics and phonology. This was to ensure the quality of natural dataset.

3.3. Materials

This study includes four English sentences including chosen target words created in order to analyze lexical stress designs. The sentences are:

1. The university will present a developmental program for the history department.
2. It is interesting to record that how our perceptions are influenced by photography.
3. I feel comfortable to communicate with my philosophy friends during the ceremony.
4. He was present to conduct a necessary research on academic growth.

These phrases offered a natural speech context, allowing individuals to create stress within linked speech instead compared separate word structures.

The target words are:

Contained, University, Present(verb), Developmental, Program, History, Interesting, Record, Photography, Perceptions, Comfortable, Communicate, Philosophy, Ceremony, Conduct, Academic

These words were chosen because they include polysyllabic patterns and commonly mis-accented items among Urdu students. Certain words too contained stress-shift patterns which enabled more detailed examination of stress difference. Every word was compared with RP pronunciation.

3.4. Data Collection Procedure

This data was collected via audio recordings of the participants reading the provided sentences. Every participant was recorded separately in a quiet environment to guarantee clearness of speech. The recordings were recorded in mobile phone recorder. Participants were told to read the sentences naturally and at a comfortable pace. No explicit instructions were given

3.5. Acoustic Analysis

The recorded information was examined via Praat software that allowed detailed acoustic analysis of speaking and improve efficiency of the results (Yaslam & Ganapathy, 2025)

Every recording was divided at the sentence, word and syllable level using TextGrid annotation.

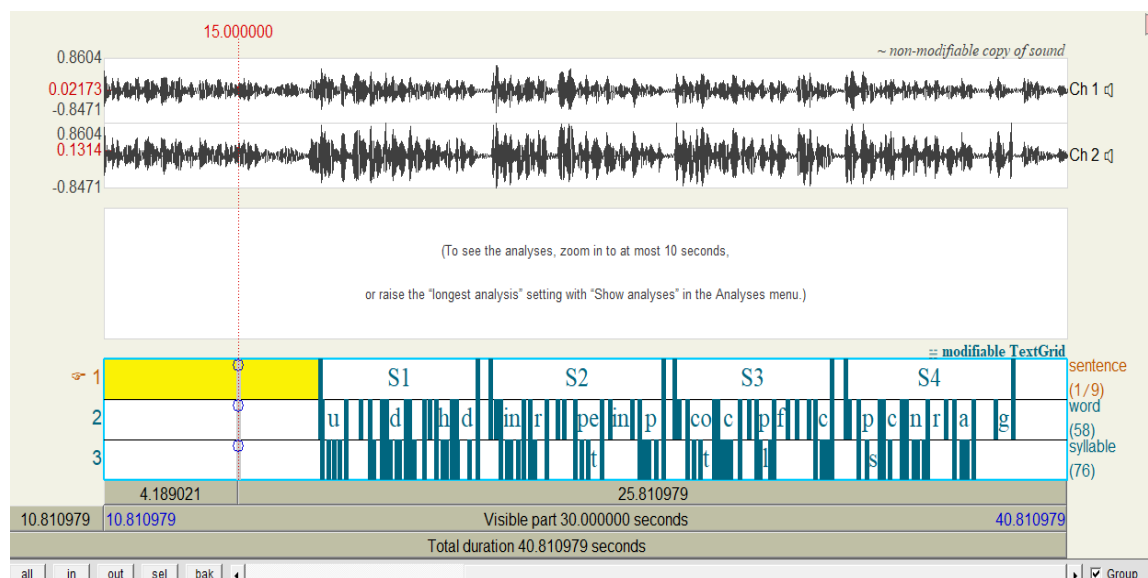


Figure 1: Representing sentence level annotation

Each recording was taken at once without breakage of sentences so that a natural conversation can be recorded.

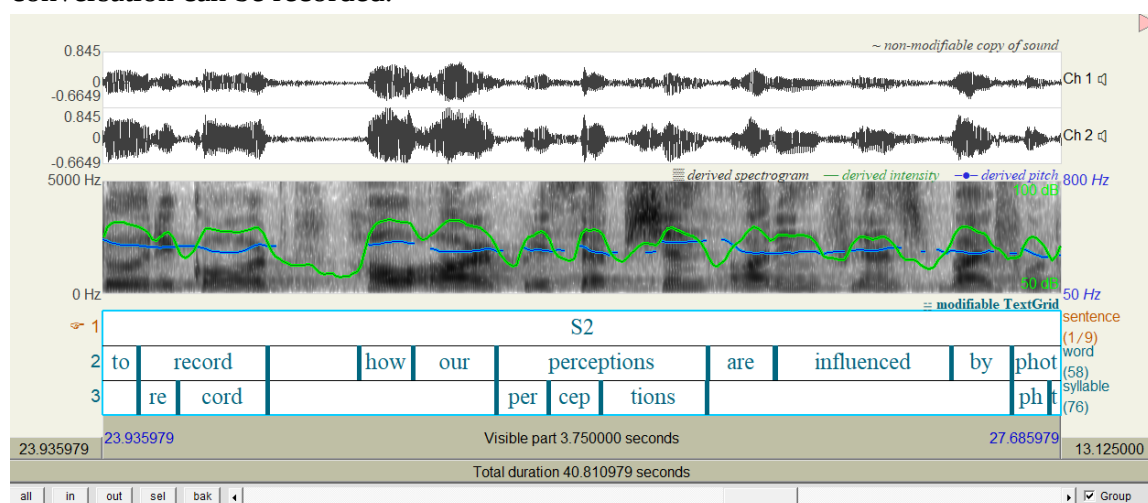


Figure 2: Representing word and syllable annotation

The words and syllables of every targeted word were recognized and tagged to control the position of stress. The data analysis was based on three main acoustic features: pitch(F0), intensity and duration. These features were used to analyze the stressed syllables.

3.6. Stress Accuracy Analysis

RP norms were used to inspect the correctness of each stressed syllable produced by the participants. In every target word, stress positioning was deemed correct when it aligned the RP standard and incorrect when it differed from it. Founded upon this contrast, a stress accuracy score was computed by every individual.

4. Data Analysis

The acoustic data gathered via Praat were arranged and examined using explanatory analytical techniques.

The analysis focuses on recognizing patterns in:

- accurate and inaccurate stress positioning
- acoustic variations among stressed and unstressed syllables

5. Ethical Considerations

Participants were informed about the objectives of research data collection. Their participation was optional and the data was confidential and utilized only for educational purposes.

6. Results and Findings

The analysis was based on the measurement of pitch (F0), duration and pitch of every syllable of the targeted words. The findings are analyzed by acoustic realization, stress placement and patterns of lexical stress of the participants.

6.1. Acoustic Measurements

A comprehensive analysis of participants' speech was exhibited by measuring pitch, intensity and duration of the syllables.

No.	Word	RP Stress	Student Stress	Accuracy	Intensity	Pitch	Duration
p2	university	3rd syllable	5th syllable	Incorrect	72.66 db	344.5 hz	0.17 s
p2	present	2nd syllable	2nd syllable	Correct	72.12 db	270 hz	0.29 s
p2	developmental	2nd syllable	4th syllable	Incorrect	72.8 db	309 hz	0.19 s
p2	program	1st syllable	2nd syllable	Incorrect	73.35 db	251 hz	0.28 s
p2	history	1st syllable	1st syllable	Correct	69.36 db	265.5 hz	0.17 s
p2	department	2nd syllable	2nd syllable	Correct	68.79 db	230.1 hz	0.26 s
p2	interesting	1st syllable	4th syllable	Incorrect	71.16db	354.9 hz	0.14 s
p2	record	2nd syllable	2nd syllable	Correct	76.98 db	304.8 hz	0.24 s
p2	perceptions	2nd syllable	3rd syllable	Incorrect	70.95 db	292.5 hz	0.31 s
p2	photography	2nd syllable	3rd syllable	Incorrect	69.14 db	224.7 hz	0.24 s
p2	comfortable	1st syllable	2nd syllable	Incorrect	72.43 db	348 hz	0.17 s
p2	communicate	2nd syllable	4th syllable	Incorrect	71.41 db	294.6 hz	0.22 s
p2	philosophy	2nd syllable	2nd syllable	Correct	71.36 db	256 hz	0.26 s
p2	ceremony	1st syllable	4th syllable	Incorrect	73.05 db	302.1 hz	0.17 s
p2	present	1st syllable	2nd syllable	Incorrect	75.51 db	291.9 hz	0.29 s
p2	conduct	1st syllable	2nd syllable	Incorrect	69.7 db	268.3 hz	0.23 s
p2	necessary	1st syllable	1st syllable	Correct	68.32 db	263 hz	0.19 s
p2	academic	3rd syllable	2nd syllable	Incorrect	73.1 db	234.9 hz	0.17 s

Figure 3: Acoustic Measurement of a Participant

Similarly, each of 7 participants stress was analyzed by using PRAAT. Analysis of acoustic features indicated that usually stressed syllables have higher pitch, greater

intensity and longer duration. Duration is most prominent factor for stress measurements. A vital observation was that acoustic stress was applied to an incorrect stress that indicated that participants could produce stress but not according to PR norms.

6.2. Stress Placement Accuracy

The stress patterns by the participants were compared with the standard Received Pronunciation (RP) to direct accuracy.

Word	Total	Correct	Accuracy %
University	7	3	42.9
Present	7	4	57.14
Developmental	7	3	42.86
Program	7	0	0.00
History	7	6	85.71
Department	7	7	100
Interesting	7	2	28.57
Record	7	7	100
Perceptions	7	3	42.86
Photography	7	1	14.29
Comfortable	7	1	14.29
Communicate	7	0	0.00
Philosophy	7	7	100
Ceremony	7	6	85.71
Present	7	3	42.86
Conduct	7	1	14.29
Necessary	7	4	57.14
Academic	7	0	0

Table 1: Stress Placement Accuracy of Targeted Words

The results showed that level of stress varies across various words. The words department, record and philosophy were pronounced with full accuracy while the words program, academic, communicate were totally mistresses by all the participants. This also highlights that polysyllabic words have higher frequency of errors. In most cases the stress is on the 2nd syllable due to the influence of L1, Urdu. Words which are same in Urdu and English, like university, record, photography, philosophy are pronounced with same stress that is in Urdu, irrespective of English word.

6.3. Participant-wise Accuracy

For the further examination, stress accuracy was measured for each participant.

	Total	Correct	Accuracy%
P1	18	8	44.4
P2	18	6	33.3
P3	18	8	44.4
P4	18	10	55.5

P5	18	10	55.5
P6	18	8	44.4
p7	18	8	44.4

Table 2: Accuracy of Stress by Participants

A prominent variation can be seen among participants. Some participants produced words with higher accuracy while others exhibited repeated stress misplacement. None of the participants reaches above 55.5% accuracy. Altogether, the findings suggest that lexical stress placement is uncertain among Urdu speaking L1 learners.

7. Discussion

The study examined the production of lexical stress by Urdu -speaking L1 learners and linked their performance with standard RP norms. It is confirmed that lexical stress remains a major challenge for learners whose first language is not English. The findings also show clear deviations from native like stress patterns.

Frequent misplacing of stress by Urdu learners is one of the main findings of the study. It is common in polysyllabic words. So, the earlier research is supported by indicating that stress accuracy is affected by word length. Larger and complex words pose greater difficulty for learners.

The strong influence of L1 transfer is another important observed. Both Urdu and English have different stress systems. Urdu has more predictable stress patterns and it depends on syllable weight and duration.

While speaking English, speakers overgeneralize the rule of L1 into L2. This often causes misplaced stress. It is commonly called as “Urdu-accented English “. In other contexts, the exact same patterns have been observed, where learners rely on L1 stress patterns. Urdu L1 learners show greater variability in acoustics correlates stress (pitch, duration and intensity) as compared to native speakers. This suggests that learners may struggle with phonetic realization even when they are aware of stress placement rules.

Moreover, the findings prove that there is difference between abilities of perception and production stress patterns. In this research, the perception- production gap has been found widely. From theoretical point of view, the framework of cross linguistics influence and prosodic transfer can explain these results. Acquisition can either be facilitated or hindered by depending on similarity of two systems. It is when learners depend on familiar phonological structures from their L1 when processing L2 input. In case of Urdu and English, learners’ pronunciation accuracy is affected due to mismatch in stress rules. The need for explicit instruction in lexical stress is highlighted by these findings.

8. Conclusion

The lexical stress production by Urdu-speaking L1 learners has been investigated in this study. The findings show that participants exhibited low to moderate accuracy during stress placement. Although many words pronounced correctly but polysyllabic

words were mostly mis-stressed. Overall accuracy was 46.1 %. Urdu learners tried to shift stress pattern to the 2nd syllable due to L1 influence. The acoustic analysis highlighted that learners were capable of construct stress through pitch, duration and intensity, however, this prominence eminence was often assigned to the incorrect syllable. This mirrors that learner face difficulty in placing stress according to RP pronunciation.

Although, this research provides great insight into Urdu- speaking L1 learners but this study has certain limitations. First, the sample size was relatively small as it contained limited numbers of participants. It may affect the generalizability of the results. Secondly, there were few sentences to analyze the results which may not completely represent all English stress patterns. Additionally, the controlled reading task may differ from natural speech production. Finally, the study mainly focuses on only Urdu learners and did not include other linguistic background people.

Future research can include a large dataset including various participants to improve the reliability of the research. Researchers can also explore stress across various proficiency levels to understand developmental patterns. It is suggested that researchers can include unplanned speech data in more natural context. Moreover, comparative studies across various L1 backgrounds are also recommended.

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