ANALYSIS OF JAVANESE LANGUAGE PROSODY (ACOUSTIC PHONETIC STUDY)

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ANALYSIS OF JAVANESE LANGUAGE PROSODY (ACOUSTIC PHONETIC STUDY)

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Abstract. *This research aims to analyze the prosody contained in Javanese using an acoustic phonetic approach. This research also uses an instrumental approach, where researchers use the Praat program to analyze the frequency, intensity, and duration of the voices of male and female Javanese speakers. Data were collected from one male Javanese speaker and one female Javanese speaker. The results of the analysis show that the frequency of the voices of male Javanese speakers tends to be lower than that of female Javanese speakers. The intensity of the voices of male Javanese speakers tends to be smaller than that of female Javanese speakers. In contrast to the frequency and intensity, the duration of the male voice is also higher than that of female voices. This research confirms that there are significant differences in vocal characteristics between male and female speakers of Javanese. These results indicate that there are distinctive linguistic patterns between the two genders in the Javanese language community.*

Keywords: *Prosody Analysis, Javanese Language*

Abstrak. Penelitian ini bertujuan untuk menganalisis prosodi yang terdapat dalam bahasa Jawa dengan menggunakan pendekatan fonetik akustik. Penelitian ini juga menggunakan pendekatan instrumental, dimana peneliti menggunakan program Praat untuk menganalisis frekuensi, intensitas, dan durasi suara penutur bahasa Jawa pria dan wanita. Data dikumpulkan dari satu penutur bahasa Jawa laki-laki dan satu penutur bahasa Jawa perempuan. Hasil analisis menunjukkan bahwa frekuensi suara penutur bahasa Jawa laki-laki cenderung lebih rendah dibandingkan penutur bahasa Jawa perempuan. Intensitas suara penutur bahasa Jawa laki-laki cenderung lebih kecil dibandingkan penutur bahasa Jawa perempuan. Berbeda dengan frekuensi dan intensitas, durasi suara laki-laki juga lebih tinggi dibandingkan suara perempuan. Penelitian ini menegaskan bahwa terdapat perbedaan karakteristik vokal yang signifikan antara penutur bahasa Jawa pria dan wanita. Hasil tersebut menunjukkan bahwa terdapat pola kebahasaan yang khas antara kedua gender dalam masyarakat bahasa Jawa.

Kata kunci: Analisis Prosodi, Bahasa Jawa

1. INTRODUCTION

Javanese is a means of communication in everyday life that is commonly used by Javanese people. Judging from the development and spread of its use, Javanese has been used in various provinces both on the island of Java and abroad. The number of users is decreasing due to the development of the national language (Bahasa Indonesia) and other foreign languages that are of interest to the younger generation. Thus, this research is important to be carried out as an effort to preserve the Javanese language for the future.

Javanese language has speech levels, commonly known as undha usuk (stratification) or unggah-ungguh (politeness): ngoko (low), madya (middle), and krama (high). Ngoko language is composed of ngoko words. This type of language is commonly used in conversation between equal interlocutors (without any social gap). Madya type is the use of ngoko speech level, interspersed with krama words. This level is used when the speaker wants to respect the other interlocutors, the interlocutors regarded older or more mature than the speaker. Krama is known as the high type in the speech, in which all uses krama vocabulary. This type is usually employed by the young to speak to the elder or to respect the otherinterlocutors (Yustanto & Henry, 2016)

Prosody or supra segmental elements include high-low sounds (tone), stress-unstress (stress), long-short (tempo), and silence (pause) that accompany an utterance. The same utterance, if spoken with different prosody, will give rise to different meanings or perceptions. If the utterance is delivered with good and correct prosody, its meaning will be well received by the interlocutor. Conversely, an utterance delivered with bad prosody can give rise to a wrong perception or misunderstanding of the intent of the utterance. With the prosody factor, an utterance will be easily understood by the listener because the speaker can put emphasis on the parts that are considered important.

Prosody or suprasegmental features always fill segmental elements in a speech. Segmental sounds produced by a speaker are phonotactic projections that are directly filled by prosodic or suprasegmental features. In general, prosody has linguistic, extralinguistic, and paralinguistic functions (Bougrine & Ziadi, 2018).

Suprasegmental prosodic features play a crucial role in human communication. These features, also known as suprasegmentals, include stress, intonation, pitch, timbre, and rhythm. While segmental features determine the individual sounds of a language, suprasegmental features help convey meaning and add nuance to spoken language. The suprasegmental prosodic will explore the various aspects of features and their importance in language communication. One of the most important aspects of language is stress, which refers to the prominence given to specific syllables within words or to specific words within a phrase (Gussenhoven, C., & Chen, A, 2018).

Stress, intonation, pitch, tone, and rhythm are important suprasegmental prosodic elements in human communication. They contribute to the social and cultural aspects of

language use by helping to convey meaning, distinguish between word meanings, express emotions and intents, and contribute to the social and cultural aspects of language usage. awareness and strengthening communication across different languages and cultures requires an awareness of these aspects. Linguists and language learners can improve their capacity to communicate successfully in varied circumstances by paying attention to suprasegmentals.

Acoustic phonetics studies sound waves as physical events or natural phenomena that form the relationship between speakers and listeners (Syarfina, 2009). According to Harrington (2010), acoustic phonetics is a science that has received contributions from three fields of science, namely linguistics (phonology), engineering (electronics), and cognitive (psychologists). A subfield of general phonetics that studies the physical properties of speech sound in terms of frequency (pitch), intensity (spectrum), and quantity (duration) (Bussmann, 2006). Acoustic phonetics, according to Marsono (2013), is the research that studies language sounds in terms of sound as a physical phenomenon, which includes aspects such as vibration frequency, amplitude, intensity, and timbre. Acoustic phonetics is the study of the acoustic characteristics of speech, including analysis and description of speech in terms of its physical properties, such as frequency, duration, and intensity (Syarfina, Zein & Yusuf, 2024).

Phonetics is the foundation for comprehending and describing speech sounds. Phoneticians study the articulatory, acoustic, and auditory elements of human vocalization in order to identify and analyze sounds in various languages. This knowledge is invaluable in the study of phonology, the linguistic discipline concerned with the sound patterns of a language. Phonetics is used by phonologists to detect and compare sounds in different languages, to create sound inventories, and to study sound change and evolution (Cutler, A., & Bunnell, H, 2019). Phonetics is a branch of linguistics that studies language sounds without regard to whether the sounds can distinguish meaning or not (Dhnawaty et al., 2017). Phonetics and prosody are important sciences in linguistics because they help us comprehend the physical qualities, production, and structure of speech sounds. Phonetics serves as a foundation for researchers to find cross-linguistic trends, provide language training, and build speech technologies. Prosody, on the other hand, contributes to a comprehension of suprasegmental characteristics of language.

In a research conducted by Yanti, F. (2019), researchers used Praat to explore vowel formants in Minang Kabau language. They concentrated on the frequency of monophthong formants /i, e, a, o, u/ and diphthongs /ai, au/. They obtained precise formant frequency measurements for each vowel using Praat's formant measurement function, which provides useful insights into the acoustic features of vowels.

And other previous studies conducted by Pranoto (2018) have revealed differences in voice characteristics between various groups of speakers, including differences between men and women in various languages. Syarfina (2014) describes the results of her research which focused on calculating the prosody of the coal dialect of Malay. Pronoto (2018), has conducted an analysis of the frequency, duration, and intensity of voices between Javanese men and women using Praat software. This research shows that the frequency of Javanese men's voices is generally smaller than women's, while the duration of men's voices is longer and their intensity is greater than women's.

Based on previous research on voice analysis and differences in voice characteristics between men and women above, there is still a research gap, namely the absence of research that analyzes the variation of voices between men and women in Javanese using Praat software and the absence of research conducted by Javanese speakers in Medan. By filling this gap, this research is expected to provide deeper insight into the differences in the voices of men and women who speak Javanese. In this case, the researcher examines how the frequency, duration and intensity of male and female voices of Javanese speakers differ.

2. RESEARCH METHODS

This research employs an experimental phonetic method to examine the prosodic characteristics of Javanese declarative speech produced by male and female speakers in Medan. The primary focus is on analyzing three key phonetic parameters: frequency, duration, and intensity. The approach involves recording speech, processing the data with software, and acoustically analyzing the resulting sound waves. Experimental phonetic method includes various studies on speech using instruments and analyzing it acoustically (Hayward, 2000; Kuswantari et al., 2022). Experimental phonetics uses instruments to

analyze several aspects of a speech and visualize the sound form in a spectrogram wave. The speech data used in this research were sourced from native Javanese speakers residing in Medan. The participants consisted of both male and female aged 30-45 years. Each participant was asked to pronounce the sentence "Kulo arek mangan iwak" meaning "I want to eat fish." The declarative nature of this sentence was ideal for exploring the prosodic features of frequency, duration, and intensity.

The speech samples were recorded using Sony ICD-PX 470 to ensure clear and high-quality audio. The Praat application (Boersma & Weenink, 2022), a widely used tool in phonetic research, was employed to record and save the speech data in WAV file format, which is optimal for acoustic analysis. The preprocessing stage involved editing the recorded audio to eliminate unnecessary sounds that could interfere with the analysis. This step included cutting out irrelevant noise at the beginning and end of the recordings, which ensured that only the desired speech segments were analyzed.

The preprocessing stage involved editing the recorded audio to eliminate unnecessary sounds that could interfere with the analysis. This step included cutting out irrelevant noise at the beginning and end of the recordings, which ensured that only the desired speech segments were analyzed. Each speech recording was segmented into syllables (/Kulo/, /arek/, /mangan/, and /iwak/), making it easier to analyze the prosodic features for each individual syllable. The Praat software was used to label each syllable and align the annotations with the acoustic waveform. This step allowed the software to identify boundaries between the speech sounds for further analysis of frequency, intensity, and duration.

3. RESULT AND DISCUSSION (Sub judul level 1)

This section outlines the findings from the analysis of declarative speech sounds produced by native Javanese speakers from Medan, specifically focusing on the frequency, duration, and intensity of the sounds. The declarative sentence used in the research is "Kulo arek mangan iwak" meaning "I want to eat fish." The research compares the differences in these three parameters between Male (M) and Female (F) speakers.

a. Frequency

Frequency is measured in Hertz (Hz) and is a fundamental prosodic feature in phonetics that deals with the pitch of the speech sounds. The results of the frequency analysis between male and female speakers can be seen in figures 1 and 2.

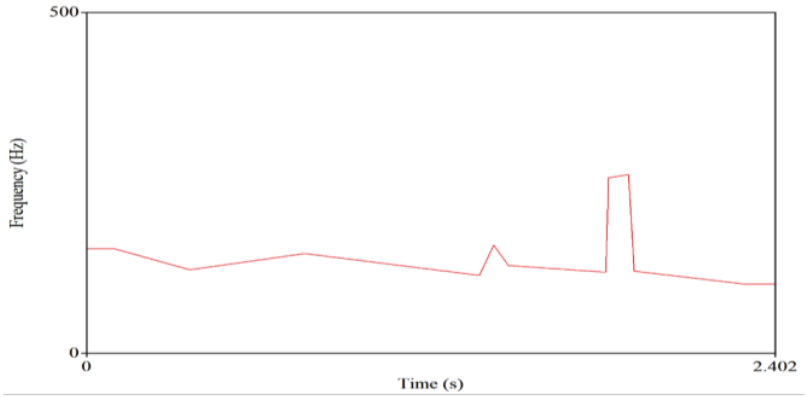

Figure 1. Frequency of Male Voice

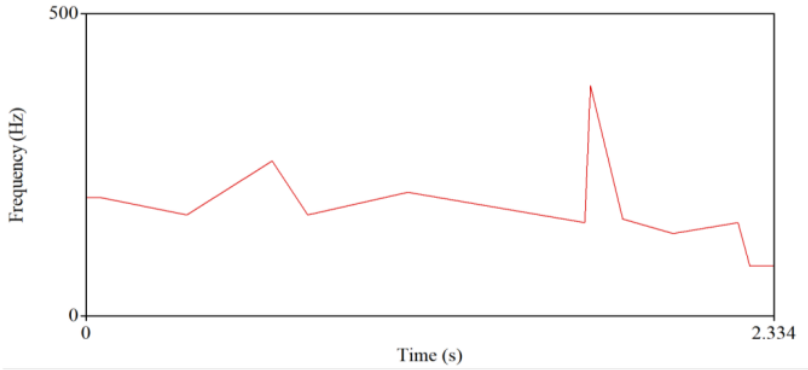

Figure 2. Frequency of Female Voice

The results show a clear difference between male and female speakers in terms of frequency, as demonstrated in Table 1.

Declarative sentence: *Kulo arek mangan iwak*	Frequency (Hz)	
	M	F
/Kulo/	132	216
/arek/	114	178
/mangan/	116	165
/iwak/	106	147

In general, male speakers had lower frequencies across all syllables compared to female speakers. For instance, the frequency of the syllable /Kulo/ was 132 Hz for male and 216 Hz for female. The differences are notable and reflect typical gender differences in pitch, where female tend to have a higher pitch range. The difference is most prominent in the first syllable, /Kulo/, where female speaker reaches a frequency of 216 Hz compared to 132 Hz for male speaker. This significant gap is not unusual, as declarative sentences in most languages, including Javanese, tend to start with a higher pitch, which can be even more exaggerated in female speech.

The trend continues throughout the sentence, with female maintaining higher frequencies across the remaining syllables, although the gap narrows somewhat in the later syllables. For instance, the frequency difference for /iwak/ (the last syllable) is 41 Hz, less pronounced than for the first syllable, /Kulo/, where the difference is 84 Hz. This diminishing frequency gap towards the end of the sentence may indicate a natural prosodic decline, known as intonational downdrift, which is common in declarative sentences (Ladd, 2008).

b. Duration

Duration refers to the length of time a syllable or speech segment is articulated and is measured in seconds. The results of the frequency analysis between male and female speakers can be seen in figures 3 and 4.

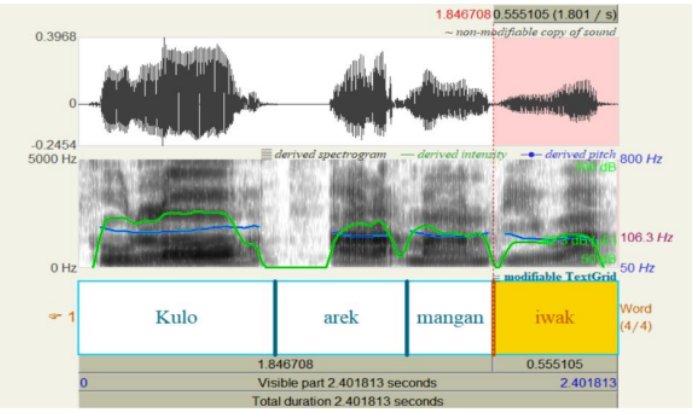

Figure 3. Duration of Male Voice

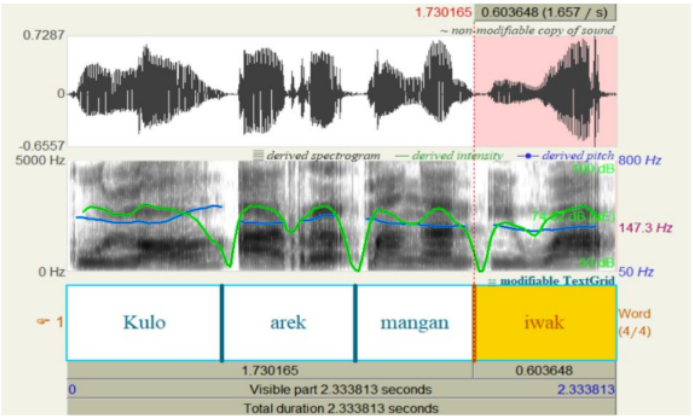

Figure 4. Duration of Female Voice

The results of the duration analysis are presented below.

Declarative sentence: *Kulo arek mangan iwak*	Duration (s)	
	M	F
/Kulo/	0.87	0.65
/arek/	0.58	0.56
/mangan/	0.38	0.50
/iwak/	0.55	0.60
Total	2.40	2.33

Duration refers to the amount of time it takes to articulate a word or voice and is a crucial aspect of speech rhythm and prosody. In this research, duration is measured in seconds and examines how long male and female speakers took to pronounce each word in the declarative sentence "Kulo arek mangan iwak." The results show that male speaker generally take longer to articulate the sentence compared to female speaker. Male speakers exhibit a slightly longer total duration (2.40 seconds) than female speakers (2.33 seconds). This may reflect a variety of factors, including physiological, psychological, and social influences that shape speech production.

c. Intensity

Intensity is measured in decibels (dB) and reflects the loudness or amplitude of the speech. The results of the intensity analysis between male and female speakers can be seen in figures 5 and 6.

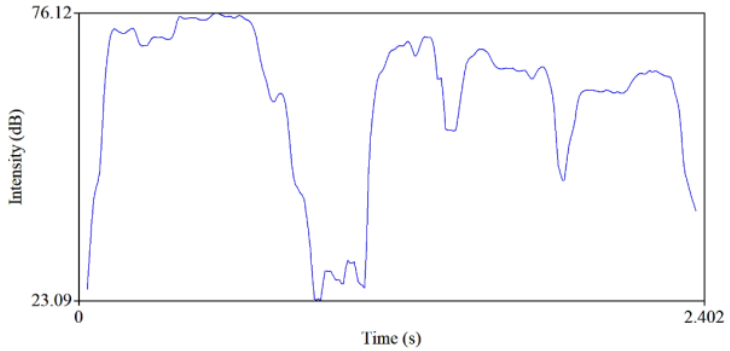

Figure 5. Intensity of Male Voice

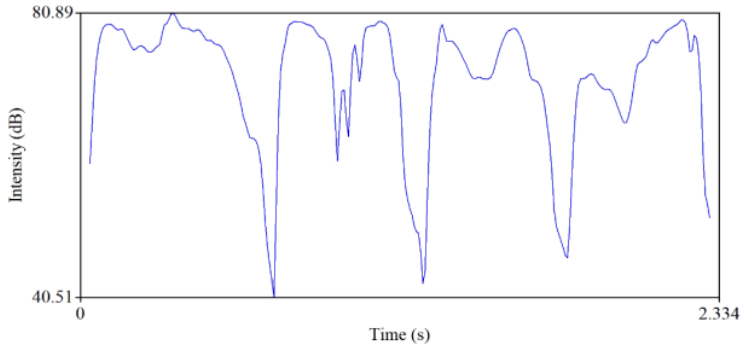

Figure 6. Intensity of Female Voice

The intensity values are summarized in the following table.

Declarative sentence: *Kulo arek mangan iwak*	Intensity (dB)	
	M	F
/Kulo/	72.57	77.02
/arek/	65.82	76.18
/mangan/	66.26	74.53
/iwak/	62.35	74.52

Female speaker consistently produced higher intensity across all words compared to male speaker. For instance, the intensity for the word /Kulo/ was 77.02 dB for female

and 72.57 dB for male, indicating that females generally spoke with more intensity or loudness. The data clearly indicates that female speaker consistently produce higher intensity values than their male counterparts. For example, in the first word /Kulo/, female speaker reaches an intensity of 77.02 dB compared to 72.57 dB for male speaker. This trend persists across all words, with the most significant difference observed in /arek/, where female intensity is 76.18 dB, significantly higher than the male intensity of 65.82 dB.

The research conducted on native Javanese speakers in Medan provides compelling insights into the differences in prosodic features between male and female speakers, particularly in terms of frequency, duration, and intensity. The findings align with broader linguistic studies while also contributing specific data on how these prosodic elements manifest in Javanese declarative sentences.

1. Frequency: Gendered Pitch Differences

One of the most distinct differences observed in the research is in the frequency, which refers to the pitch of the speech. Across all words in the declarative sentence "Kulo arek mangan iwak", female speaker consistently exhibited higher pitch values than their male counterparts. For instance, the word /Kulo/ was produced with an average frequency of 216 Hz by female speaker, compared to 132 Hz by male speaker. This trend is well-documented in linguistic research, where females typically have higher fundamental frequency due to biological differences in vocal fold size and structure (Pépiot & Arnold, 2021). The average pitch difference of 84 Hz in the first word of the sentence suggests that female speakers not only have a higher pitch range but also tend to initiate speech with a more pronounced rise in frequency, which is common in declarative sentences.

The diminishing gap between male and female pitch in the later words, particularly for /iwak/, where the frequency difference narrows to 41 Hz, may indicate the presence of intonational downdrift. This phenomenon, where pitch gradually lowers throughout the course of a declarative sentence, is a feature observed across many languages, including Javanese. This finding is consistent with Ladd's (2008) observations that downdrift helps to signal the end of a declarative sentence, thus adding to the overall prosodic structure of the sentence.

However, while these pitch differences are expected in a binary gender comparison, the magnitude of the difference in the Javanese context—especially in the initial word—may also point to cultural and linguistic factors. Javanese, like many other languages, may impose stylistic or sociolinguistic norms that influence how men and women adjust their pitch for certain sentence types. Female speaker's tendency to use higher pitch may be influenced by norms related to politeness, formality, or emphasis, all of which are significant in Javanese sociolinguistic contexts.

2. Duration: Male Speakers and Prolonged Articulation

The duration results in this research reveal another dimension of gender difference. Male speaker took longer on average to articulate the entire declarative sentence than female speaker. Specifically, male speaker's articulation spanned 2.40 seconds, compared to 2.33 seconds for female speaker, although the difference is slight. This result mirrors findings in other linguistic studies (Byrd, 1994; Simpson, 2009), which indicate that men often exhibit slower speech rates compared to women. The reasons for this difference can be both physiological and psychological. Men's slower speech production may reflect differences in vocal tract dynamics, which can lead to longer articulation times. Psychological factors, such as a more deliberate speech style or differences in cognitive processing during speech, may also play a role.

Interestingly, the distribution of these durational differences across words is not uniform. For instance, male speakers prolonged the first word, /Kulo/, for 0.87 seconds, compared to 0.65 seconds for female speakers, marking the most significant difference. In contrast, female speakers articulated the second and last words, /mangan/ and /iwak/, slightly longer than their male counterparts. This suggests that while male speakers may have a tendency toward slower overall speech, female speakers might prioritize longer articulation in key content-bearing words, perhaps to enhance clarity or emphasis.

The nuanced differences in duration could also reflect varying communicative strategies. Male's tendency toward slower speech may align with more assertive or authoritative speech patterns, while women may prioritize prosodic variability, leading to more dynamic pacing between words. These findings offer an opportunity to further explore the intersection of gendered speech patterns and social interaction in the context of Javanese speech.

3. Intensity: Loudness and Gendered Communication

When examining intensity, the research finds that female speakers consistently produced higher decibel values across all words, signaling that they tend to speak with greater loudness compared to male speaker. For example, the first word /Kulo/ had an intensity of 77.02 dB for female speaker, while for male speaker, it was 72.57 dB. These intensity differences are not surprising given previous studies that suggest women, across various cultures and languages, often use greater vocal intensity in conversational settings (Hwa Chen, 2007). This could be a compensatory strategy to ensure audibility, given that higher-pitched voices (as typical of female speech) may be perceived as less loud at similar decibel levels. Therefore, women may naturally or socially adapt by increasing loudness to balance out the perceptual effects of higher frequency.

Cultural norms around communication may also play a role in these intensity differences. In Javanese culture, as in many others, speech dynamics, including volume, may be influenced by social expectations. For example, women might feel compelled to speak louder in certain settings to assert presence or authority, especially in mixed-gender interactions where louder speech could be associated with confidence or assertiveness. Moreover, these intensity differences could be linked to the specific phonetic structure of Javanese. For instance, the language might encourage female speakers to employ higher intensity as a means of enhancing the clarity or expressiveness of certain words, especially in formal or declarative contexts. Female speaker's higher intensity, particularly in the middle and end of the sentence, suggests a deliberate use of loudness to maintain listener engagement and signal importance, especially in words like /arek/ and /iwak/.

The research's findings contribute to a growing body of research on gender differences in speech, with specific reference to Javanese phonetics. The gendered differences in frequency, duration, and intensity align with broader linguistic trends but also provide insights unique to Javanese prosody. These differences could inform future research on how gender, culture, and language interact to shape speech patterns.

4. CONCLUSION

Future studies should investigate whether these gendered differences in prosodic features are consistent across different Javanese dialects or within various social settings. Such research could provide a broader understanding of the sociolinguistic dynamics that influence speech. While this research focused on a structured declarative sentence, future research should explore gender differences in more spontaneous, natural conversation. This could reveal how prosodic features change in less controlled environments and offer insights into everyday communication patterns. In addition to frequency, duration, and intensity, future studies should examine other prosodic features such as stress, rhythm, and pause patterns. This could provide a more comprehensive understanding of the gender differences in Javanese speech. Further research could also explore the role of social, cultural, and educational influences on these prosodic characteristics. Understanding how social status, education, and gender roles shape speech in Javanese culture could offer valuable insights for sociolinguistics. By expanding on these suggestions, researchers can build a more nuanced understanding of the interaction between gender, culture, and language in phonetic studies.

This research has examined the prosodic characteristics of Javanese declarative speech produced by male and female speakers in Medan, focusing on three key phonetic parameters: frequency, duration, and intensity. The results confirm significant gender differences across these parameters, aligning with established linguistic research while offering unique insights into the Javanese context.

Female speaker consistently exhibited higher frequencies (pitch) compared to their male counterparts, a reflection of biological differences and possibly sociolinguistic factors. The research also revealed that male speaker tends to have a longer duration in speech articulation, though the overall difference was slight. This suggests that men may adopt a more deliberate speech style, possibly influenced by physiological or cognitive factors. In terms of intensity, female speaker produced higher decibel levels across all syllables, suggesting an adaptation to compensate for higher pitch or possibly a sociocultural strategy to assert presence or enhance clarity.

These findings not only highlight the biological and phonetic aspects of speech but also underscore the influence of sociocultural factors in shaping speech patterns. The

differences in prosody between male and female speakers may be influenced by societal expectations, communication strategies, and norms specific to Javanese culture

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PAGE 1

PAGE 2

PAGE 3

PAGE 4

PAGE 5

PAGE 6

PAGE 7

PAGE 8

PAGE 9

PAGE 10

PAGE 11

PAGE 12

PAGE 13

PAGE 14

PAGE 15