

The Acoustic Characteristics Based on Frequency Speech of Interrogative Sentences at Mandailing Language in Sei Mati District, Medan

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Abstract: Mandailing language there are three suprasegmental phonemes which are composed of two pressures and one pause. Pressure is the difference in the loud or soft sound of the syllable, and the difference in the stress can cause the different meanings. There is a very significant difference between the male basic tone frequency and female basic tone frequency. The male basic tone frequency is lower 48.85 Hz than the female basic tone frequency. Based on the calculation/acoustic measurement there was no significant difference between, the frequencies of the male final tone with the female final tone. The male final tone frequency is 9.92 Hz lower than the female final tone frequency. Based on the result of calculation/acoustic measurement there is no significant difference between, the male lower tone frequency with the female lower tone frequency. The male lower tone frequency is 236.06 Hz lower than the female lower tone frequency

Keywords: acoustics characteristics; speech; interrogative sentence; Mandailing language

Date of Submission: 04-11-2017

Date of acceptance: 13-11-2017

I. INTRODUCTION

Indonesia consists of various tribes and each tribe has its own language which distinguishes it from other tribes. The language used by each tribe is the local language. The regional languages which are spread throughout the country are a cultural treasure of the Indonesian nation that is protected by the state. The guidance and the development of regional languages are very important, because besides as a national cultural richer, it is also the values of traditional culture are expressed in regional languages. Thus, local languages must be preserved and preserved in order to remain a container of the cultural expression of its people.

In Mandailing language there are three suprasegmental phonemes which are composed of two pressures and one pause. Pressure is the difference in the loud or soft sound of the syllable, and the difference in the stress can cause the different meanings. Pause is a place of rest (noiseless) between parts of the sentence, moving pauses can change meaning.

Recalling the importance of the regional languages function, it is necessary to conduct a fundamental research seriously on the local language in Indonesia. The study of regional languages is one of the preservation of regional languages as Kridalaksana (1986) says that:

"... The preservation and development of regional languages including the maintenance of Indonesian language resources can still be accomplished. This is in accordance with the 1945 Constitution Chapter XV of article 36 which states that languages are used as a life-liaison and nurtured by the people of their speakers, nurtured and protected by the State because it is part of the culture of life "

Mandailing language is one of the regional languages in Indonesia used in the Mandailing area and in other areas of the overseas in the implementation of communication among Mandailing ethnic groups. As a basis of research that the language Mandailing has a soft and soft rhythm and rhythm delivered with subtle pressure.

In Mandailing language there are dialect variations, namely the Angkola dialect and the Mandailing dialect. The Angkola dialect is found the phoneme/h/ at the beginning of the word, and there is only a double consonant sound, while in the Mandailing dialect the phoneme /h/ becomes lost and pronounced with the initial vowel, except the phoneme /h/ in *ho* (you). Mandailing language is one of the regional languages that have acoustic characteristics, It should be investigated in more depth because it is assumed there are differences in the use of Mandailing language that is influenced by sex and age. The factors affecting the deeper differences of acoustic features will certainly be observed clearly after knowing the difference between how to state interrogative sentences in Mandailing languages.

II. LITERATURE REVIEW

2.1 Acoustic Definition

The word acoustic means the branch of physics that includes the elements of sound, which in the context of the sound language transmitted in speech. Acoustic phonetics are also called physical phonetics, mathematical phonetics, or instrumental phonetics, as they relate to sound waves propagating in the air (Fonetik.http:// bahasa.web.id.23 February 2008).

The objects of acoustic phonetics are sound waves that are spoken and heard during transmission. Sound movement from wherever the source or its origin encompasses the air physically involves the subsequent increase and decrease of air pressure in vibration to the vanishing point.

Lapoliwa (1998: 44) says acoustic structures differ in terms of the pitch, hardness or quality of vowel sounds [i] and [e], for example, they will remain indistinguishable even though they are pronounced with the same high, loud tones as sounds, they have their own quality. On the contrary, the same vowel, for example [a], when it is pronounced with a different high or loudness, we will be able to hear that [a] is first other than the second [a] in terms of height or softness. Bright (1992) adds that acoustic phonetics investigates sound waves as physical events or natural phenomena that form the relationship between the speaker and the listener.

2.2 Interrogative Sentences

Keraf (1978: 174) states that sentence is a sentence that contains a request for us to be told something because we do not know something. S.T.Alisjahbana (1977: 65) says that according to the contents of the question is a person's utterance to a person, stating that the one who asks it does not know, and wants (asked, enjoin, reign) to be informed of what he does not know. Sibarani (1997: 138) sentence is a sentence that asks a question on someone by expecting responses in the form of answers also called interrogative sentences. Interrogative sentences are also called question phrases that are formally marked by a question word like who, how, when, and how with or without the particle as a confirmation.

This research focuses on the interrogative mode, which is a mode that states a question that aims to ask something to a person by expecting a response in the form of an answer or a request if the conversation, for its sake, asks the other person to do something. The impressionistic research (a study that relies on the sensitivity of the hearing to identify the sounds of language) is necessary for phoneticians to have a sharp and well-trained hearing device. It aims to analyze the sounds of language, to identify the sounds in different languages in the articulator dimension, and to describe them in understandable phonetic symbols.

III. RESEARCH METHODS

This research uses quantitative descriptive analysis method. According to Prasetyo (2005: 42), descriptive research is a study conducted to obtain a more detailed picture of a phenomenon. This research is conducted by quantitative type because it involves calculation or number or quantity (Moleong, 1993: 2). This method is used to find out the acoustical features of Mandailing's interrogative sentences. In this research, an instrumental approach is conducted with the help of accurate measuring instruments with Praat software, while the measurement and description of procedural characteristics of speech is done by adopting the steps in the IPO (Instituut voor Perceptie Onderzoek). The IPO theory process starts from the later speech to obtain the speech's melodic curve, measured frequency, intensity and duration. The target sentences to be researched and measured are the sentences with interrogative mode, consisting of nominal interrogative sentences, interrogative causal, interrogative temporal, interrogative numeral, interrogative adjective interrogative spatial and verbal interrogative

3.1 Research Population

The population of this research is the speakers of the Mandailing language in Medan City domiciled in the area of Sei Mati Medan who use the first language and the second language. The first language speakers are those who use the Mandailing language as everyday language. While the second language is using the Mandailing language and the Indonesian language is balanced use in everyday life.

3.2 Research Samples

The sampling technique used is a purposive sampling which means that the sample unit to be contacted will be adjusted to certain criteria determined based on or lead to the achievement of the research objectives (Nawawi 1998: 157). This is also related to the number of respondents used where for populations with high degree of uniformity, the samples taken are also homogeneous, so no more samples are required, meaning the more uniform the population, the smaller the sample can be taken because the sample considered to have been sufficiently representative for study (Singarim-bun, 1995: 150).

The larger the sample will be the higher the sample representative level. This provision is valid as long as the population is not perfectly homogeneous. If the population is perfectly homogeneous, the sample size does not affect the level of sample representation (Suryabrata 1989) for such a population is quite small sample.

The sample of this research is Mandailing language speakers taken by twenty Mandailing speakers with gender balance criteria, that is five female and five male speakers aged 20-40 years and five female and five male speakers aged 41-60 years .

3.3 Data Collection Techniques

The stages used to collect data in this research are:

- a. Directing the respondents to say the target sentence that is seven interrogative sentences that to be pronounced one by one, consisting of: nominal interrogative sentences, temporal interrogative sentences, numeral interrogative sentences, adjective interrogative sentences, spatial interrogative sentences, causal interrogative sentences, and verbal interrogative sentences and each sentence is pronounced three times.
- b. Recording the respondents' speeches in realizing the interrogative sentences of Mandailing language with interrogative mode. In this research, the data was recorded by using Sony Stereo Cassette Corder equipped with SHURE model head mic mic SM 10 A. The advantage of this instrument is to record the voice in stereo form so that the speech can be placed in different tracks and the sensitivity of recording that can be adjusted with voice loudness speaker. The microphone is used in addition to very sensitive, can also keep the distance between the mouth with a microphone so that it is relatively stable and fixed because in pairs in the head. This can simplify the process of digitizing the recording for further processing.
- c. The recordings are made during the day from 2 pm to 5 pm for six business days

3.4 Data Processing Techniques

All the data collected is processed by using Praat computer tool version 4.0.27, because this program is a very simple program but can perform acoustic analysis with high accuracy and does not require large storage media. This tool is also used by researchers in experimental phonetic field namely Remijsen (2002), Sugiyono (2003), and T. Syarfina (2008). It can easily measure the frequency, intensity and duration developed first in Amsterdam. In detail the stages of data processing are:

- a. The digitization stage, the data are recorded first to an audio cassette which then incorporated into a digital form of sound wave format, then the best chosen speech among the three sentences uttered for analysis.
- b. The data segmentation stage, that is the data are selected and separated into a single segment, in this case segmentation sentences per sentence.
- c. The measurement of frequency, intensity, and duration. The measurements are made by adapting the theory of IPO (Instituute voor Perceptie Onderzoek) Collier, Cohen and Hart Hart, 1993).
- d. The statistical test is conducted to find out the significance of the acoustic characteristics of the measurement result. In the measurement of this stage, SPSS computer version 15 (Statistics Package for Social Scientist) is used.

3.5 Statistical Test

After the measurement of acoustic characteristics and extracting the measurement results to the base of the data for statistical analysis, which aims to know the significance or not significant acoustic characteristics using the SPSS computer program version 15 (Sugiyono, 2003

0.000 - 0.049 is very significant

0.050 - 0.099 is significant

0.100 - 0.149 is quite significant

0.150 - 0, ... is insignificant

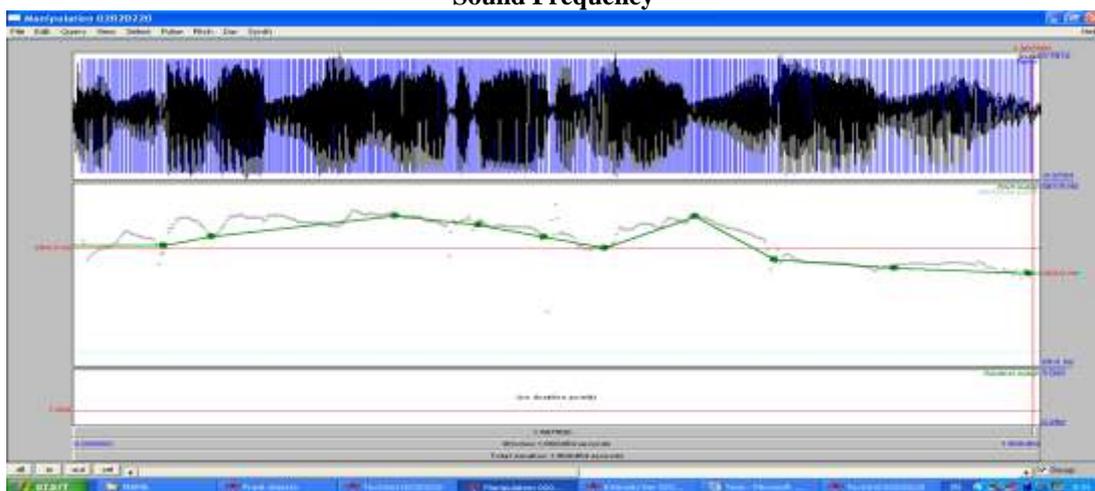
IV. DISCUSSION

The measurement of the frequency of sound waves is based on how many waves in a one-second period are given units of Hertz (Hz). The term Hertz was used to commemorate the German physicist Heinrich Hertz who died in 1894 (Hayward, 2000: 27). Hertz is the unit of number of waves. One wave is called a cycle or cycle, which is a one-wave repetition or a period.

The sound frequency determines the high tone of a sound. The higher the frequency or the shorter the cycle the higher the sound tone. Frequency determines pitch or tone. It is difficult to describe concretely the sound, because the sound can be spoken but can not be accurately observed. However, from a physics standpoint, sounds can be measured and depicted in graphical form describing sinusoidal waves that is repetitive waves (Hayward, 2000: 26) so that sound can be described as a series of cycles. In the speech, the realization of this acoustic feature is influenced by the thickness of the vocal cords and the tension of the vocal cords, (Sugiyono, 2003). The thinner or more tense, the higher the frequency generated. Conversely the thicker or more sagging the vocal cords the lower the frequency generated. The state of the vocal cords is what causes the female voice frequency tends to be higher than the male voice frequency.

Accordingly, this study found that the interrogative acoustic character of the Mandailing language can be seen that the difference in female voice frequency is higher than the male voice frequency. After the recording, the researcher measured the seven sentences of Mandible interrogative speech targets against male respondents compared with female respondents and respondents aged 20-40 years compared with respondents aged 41-60 years. Each respondent speaks seven sentences. The results of the speech can be seen in the picture below

Figure 1
Sound Frequency



4.1 Basic Tone

The basic tone is the initial tone of the utterance used in the mention of fundamental frequencies. This basic note is used as a reference for the description of other tones. From the results of research conducted, the basic tone of voice frequency on male gender is lower 48.85 Hz than the female gender. Of the seven target sentences given only in sentence 2 (interrogative temporal) the basic male tones are higher 14.33 Hz than the female base tones.

Table 1
Frequency of Basic Tone Based on Gender

Gender	N	Sentence 1	Sentence 2	Sentence 3	Sentence 4	Sentence 5	Sentence 6	Sentence 7
Male	10	29,45	38,31	14,33	15,67	14,14	16,10	13,15
Female	10	32,80	23,98	23,65	24,32	23,26	25,24	22,61

From the table above can be seen that the comparison of tone frequency based on gender can be seen below:

Sentence 1 of male basic tone is 29.45 Hz, while the female basic tone is 32, 80 Hz, so the difference is 3.35 Hz lower than the male basic tone frequency. Sentence 2 of male basic tone is 38.31 Hz, the female basic tone is 23.98 Hz, so the difference is 14.33 Hz higher than the male basic tone frequency, the sentence 3 of male basic tones is 14.33 Hz, the female basic tone is 23.65 Hz, so the difference is 9, 32Hz lower than the male basic tone frequency, sentence 4 of male basic tone is 15.67 Hz, meanwhile the female basic tone 24.32 Hz, so difference is 8.65 Hz lower frequency of male basic tone, sentence 5 of male basic tone is 14.14 Hz, while the female basic tone is 23.26 Hz, so the difference is 9.12 Hz lower than the male basic tone, the sentence 6 of male basic tone is 16.10 Hz, while the female basic tone is 25.24 Hz, so the difference is 9.14 Hz lower than male basic tone frequency and sentence 7 of male basic tone is 13.15 Hz, while the female basic tone is 22.61 Hz, so the difference is 9.46 Hz lower than the male basic tone frequency.

4.2 Final Tone

The final tone is the tone at the end of the intonation of the speech. From the results of the research conducted in general, the frequency of the final tone of male voice is lower than 9.92 Hz female final tone.

Table 2
Frequency of Final Tone Based on Gender

Gender	N	Sentence 1	Sentence 2	Sentence 3	Sentence 4	Sentence 5	Sentence 6	Sentence 7
Male	10	29,45	38,31	14,33	15,67	14,14	16,10	13,15
Female	10	32,80	23,98	23,65	24,32	23,26	25,24	22,61

From the table above, it can be seen that the comparison of the final tone frequency by gender can be seen that sentence 1 of the male final tone is 44.06 Hz, the female final tone is 25.54 Hz, so the difference is 19.06 Hz higher than the male final tone frequency, sentence 2 of male final tone is 20.19 Hz, while the female final tone is 24.99 Hz, so the difference 4.80 Hz is lower than the male final tone frequency, sentence 3 of male final tone is 30, 74 Hz, the female final tone is 20.69 Hz, so the difference 10.05 Hz is higher than the male final

tone frequency, sentence 4 of male final tone is 12.13 Hz, the female final tone is 19,71 Hz, so the difference is 7.58 Hz is lower the male final tone frequency, sentence 5 of male final tone is 36.43 Hz, the female final tone is 22.08 Hz, so the difference is 14.35 Hz higher than the male final tone frequency, sentence 6 of male final tone is 21.49 Hz, while the female final tone is 61.06 Hz, so the difference is 3 9.57 Hz lower than the male final tone frequency and sentence 7 of male final tone is 20.78 Hz, the female final tone is 21.67 Hz, so the difference is 0.82 Hz lower than the male final tone frequency.

4.3 Lower Tone

Lower tone is the tone used to mention the undertones of a speech. From the results of the research conducted, the lower tone of voice frequency on male gender is lower 236.06 Hz than the undertones of female gender.

Table 3
Lower Tone Frequency by Gender

Gender	N	Sentence 1	Sentence 2	Sentence 3	Sentence 4	Sentence 5	Sentence 6	Sentence 7
Male	10	4,90	4,75	6,24	1,66	4,01	8,37	5,18
Female	10	6,66	7,54	10,32	7,47	39,10	174,30	26,78

From the table above it can be seen that the comparison of lower tone frequencies by gender in sentence 1 of male lower tone is 4.90 Hz, while female lower tone is 6.66 Hz, so the difference is 1.76 Hz lower than the male lower tone frequency, sentence 2 of male lower tone is 4.75 Hz, while the female's is 7.54 Hz, so the difference is 2.79 Hz lower than the male lower tone frequency, sentence 3 of male tone lower is 6,24 Hz , while the female lower tone is 10.32 Hz, so the difference is 4.08 Hz lower than the male lower tone frequency, sentence 4 of male lower tone is 1.66 Hz, while the female's is 7.47 Hz, so the difference is 5.81 Hz lower than the male lower tone frequency, sentence 5 of male lower tone is 4.01 Hz, while the female's is 39.10 Hz, so the difference is 35.09 Hz lower than the male lower tone frequency, sentence 6 of male lower tone is 8.37 Hz, while the female's is 174,30 Hz, so the difference is 165.93 Hz lower than the male lower tone frequency and sentence 7 of male lower tone is 5.18 Hz, while the female's is 26.78 Hz, so the difference is 21.60 Hz lower than the male lower tone frequency.

4.4 Upper Tone

The upper tone is the tone used to mention the top or high tone of a speech. From the results of research conducted in general, then the frequency of the tone of the voice on the male gender is 109.55 Hz higher than the tone of the female gender.

Table 4
Upper Tone Frequency by Gender

Gender	N	Sentence 1	Sentence 2	Sentence 3	Sentence 4	Sentence 5	Sentence 6	Sentence 7
Male	10	78,01	62,45	37,26	36,15	51,40	77,23	46,29
Female	10	40,71	31,72	33,23	34,06	33,14	65,80	40,58

From the above table, it can be seen that the ratio of the upper tone frequency to the sentence 1 of male upper tone is 78.01 Hz, while the female upper tone is 40.71 Hz, so the difference is 37.30 Hz higher than male upper tone frequency, sentence 2 of male upper tone 62.45 Hz, while the female's is 31.72 Hz, so the difference is 30.73 Hz higher than the male upper tone frequency, sentence 3 of male upper tone is 37,26 Hz, while the female upper tone is 33.23 Hz, so the difference is 4.03 Hz higher than the male upper tone frequency, sentence 4 of male upper tone is 36.15 Hz, while the female's is 34.06 Hz, so the difference is 2.09 Hz higher than the male upper tone frequency, sentence 5 of male upper tone is 51.40 Hz, while the female's is 33.14 Hz, so the difference is 18.26 Hz higher than the male upper tone frequency, sentence 6 of male upper tone is 77,23 Hz, while the female's is 65,80 Hz, so the difference is 11,43 Hz higher than male upper tone frequency and sentence 7 of male upper tone is 46.29 Hz, while the female's is 40.58 Hz, so the difference is 5.71 Hz higher than the male upper tone frequency.

The term acoustic features such as frequency, intensity and duration are as a sign that the three acoustic characteristics are related to each other. As well as the linkage among the basic tone, the final tone, the lower tone and the upper note indicating that there is a connection. For example the basic tone can be used as a comparison with other tones. This study is to describe the acoustical characteristics of Mandailing languages, that is the frequency, intensity, and duration of interrogative sentences based on gender and by age. From this research results, it can be obtained the difference of the interrogative sentence sentences in Mandailing language.

To analyze the research results from the field, the data acquisition results are incorporated into SPSS program version 15. The output of this program is to determine whether the resulting data is significant or not. From the research the frequency and intensity will be analyzed into the basic tone, final tone, lower tone and top notes. The research on the duration, performed on each vowel of the seven interrogative sentences studied. As has been explained at the beginning of the study, the object of research is the respondents by sex and age group.

Gender-based study is based on male and female, while the age-based study is on the ages of 20-40 years and 41-60 years. The results of statistical study uses the SPSS program to see whether or not there is a significant difference between the types of research objects over the pronunciation of interrogative speech. The percentage of significant or not spoken vowels is seen from the Anova table generated by the SPSS program. The percentage of there is a significant or not on the vowel speech is based on the provisions of Sugiyono (2003) as follows:

0.000 - 0.049 is very significant

0.050 - 0.099 is significant

0.100 - 0.149 is quite significant

0.150 - 0, is insignificant

If the statistical results reach 0.000-0,049 it is considered that the result identifies a very significant difference. If the statistical test number reaches 0.050-0999 identifies a significant difference. Statistical tests that reached a significant level of 0.100-0.149 identified significant differences. When the statistical test reaches 0.150-0, ... identifies no significant difference. Here is described the research conducted in the field whose data is processed based on statistical results.

4.5 Frequency by Gender

The frequency of sound waves issued is based on how many sound waves are discharged within a second. Meanwhile wave is the sound vibration in the air. The cycle is the full repetition of a single wave. The description of the results of the research on the frequency of sound waves to the seven interrogative sentences observed on the tone, final, lower and upper tones are described below.

After the data to the seven sentences uttered by male and female are included in the SPSS version 15 program, then the results are significant or not, can be read in the table below:

Table 5
Frequency of Basic Tone by Gender

Probability	Sentences						
	1	2	3	4	5	6	7
P	0,959	0,434	0,009	0,017	0,017	0,000	0,011

From the table above, it can be seen that the results of statistical measurements for the basic tone frequency based on gender shows that sentence 1 with $p = 0.959$ and, sentence 2 with $p = 0.434$ there is no significant difference being sentence 3 $p = 0,009$, sentence 4 $p = 0,017$, sentence 5 $p = 0,017$, sentence 6 $p = 0,000$, and sentence 7 $p = 0,011$ there is a very significant difference.

After the data to the seven sentences uttered by male and female are included in the SPSS version 15 program, then the results are significant or not can be read in Anova table below:

Table 6
Frequency of Final Tone by Gender

Probability	Sentences						
	1	2	3	4	5	6	7
P	0,077	0,486	0,316	0,012	0,232	0,008	0,910

From the table above, it can be seen that the results of statistical measurements for final tone frequency by sex shows that sentence 2 with $p = 0.486$, sentence 3 with $p = 0,316$, sentence 5 with $p = 0,232$ and, sentence with 7 with $p = 0,910$ not significant whereas sentence 1 with $p = 0.077$ is significant and sentence 6 with $p = 0.008$ is very significant.

After the data to the seven sentences uttered by male and female are included in the SPSS version 15 program, then the results are significant or not can be read in Anova table below:

Table 7
Frequency of Lower Tone by Gender

Probability	Sentences						
	1	2	3	4	5	6	7
P	0,000	0,392	0,241	0,013	0,225	0,006	0,236

From the table above it can be seen that the statistical measurement results for lower tone frequency by sex shows that sentence 2 with $p = 0,392$, sentence 3 with $p = 0,241$, sentence 5 with $p = 0,225$ and sentence 7 with $p = 0,236$ is not significant sentence 1 with $p = 0.000$, sentence 6 with $p = 0.006$ is very significant while sentence 4 with $p = 0.013$ is quite significant.

After the data to the seven sentences uttered by male and female are included in the SPSS version 15 program, then the results are significant or not can be read in Anova table below:

Table 8
Frequency of Upper Tone by Gender

Probability	Sentences						
	1	2	3	4	5	6	7
P	0,000	0,098	0,698	0,824	0,223	0,635	0,671

From the table above it can be seen that the statistical measurement results for the top tone frequency by sex shows that sentence 4 with $p = 0.698$, sentence 4 with $p = 0,824$, sentence 5 with $p = 0,223$ sentence 6 with $p = 0,635$, sentence 7 with $p = 0.671$ is not significant while sentence 1 with $p = 0,000$ is very significant and sentence 2 with $p = 0.098$ is significant.

V. CONCLUSION

After the seven interrogative sentences of the Mandailing language are studied against the twenty respondents by gender and age factor using Sony Stereo Cassette Corder and analyzed with SPSS 15 version computer which is useful to determine the significance or not of the research result. So the results of the study can be summarized as follows:

- a. Based on the calculation/acoustic measurement, there is a very significant difference between the male basic tone frequency and female basic tone frequency. The male basic tone frequency is lower 48.85 Hz than the female basic tone frequency.
- b. Based on the calculation/acoustic measurement there was no significant difference between, the frequencies of the male final tone with the female final tone. The male final tone frequency is 9.92 Hz lower than the female final tone frequency.
- c. Based on the result of calculation/acoustic measurement there is no significant difference between, the male lower tone frequency with the female lower tone frequency. The male lower tone frequency is 236.06 Hz lower than the female lower tone frequency.
- d. Based on the calculation/acoustic measurements there is no significant difference between the male upper tone frequencies with the female upper tone frequency. The male upper tone frequency is 109.55 Hz higher than the female upper tone frequency.

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Waridah The Acoustic Characteristics Based on Frequency Speech of Interrogative Sentences in Mandailing Language in Sei Mati District, Medan.” IOSR Journal Of Humanities And Social Science (IOSR-JHSS), vol. 22, no. 11, 2017, pp. 83-90.