

Acoustic Duration of Arabic Utterances Spoken by the Indonesian Learners of Arabic

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Abstract: This paper describes the acoustic features of Arabic utterances in terms of duration in three main modes of speech function: declarative, interrogative, and imperative modes. In this study, the duration of the speakers' utterances are distinguished regarding their acoustic quality. In conducting this research, the method was the experimental method which was used to measure the duration with regard to the acoustic feature. In this experiment, this study employed the computer program 'Praat' to measure the acoustic duration of Arabic utterances. The data was recorded from four Indonesian learners of Arabic and one native speaker of Arabic. The target utterances used in this study were [akaltu alaruzza maʃa al dajā ji fī al yadāi], [matā yaḏhabu aḥmad ilā al sūqi] and [χuḏ hāḏā al kitāba yā ʕuḥmān]. The findings showed that the duration of the Indonesian learners were different with the native Arabic when pronouncing the target utterances. In declarative utterance, the native Arabic duration was 487.55 Hz greater than the Indonesian learners and the high duration of the native Arabic was 512.02 Hz higher than the Indonesian learners. On the other hand, the low duration of the Indonesian learners were lower (106.334 Hz) than the Arabic speaker, whereas in terms of temporal duration, the Indonesian learners had longer tempo (4.6259 ms) than the Arabic speaker. In terms of the interrogative utterance, the initial duration of the Arabic speaker was higher (269.034 Hz) than the Indonesian learners (259.403) and the high duration of the Arabic speaker was higher (538.814) than the Indonesian learners. The low duration of the Indonesian learners were lower (113.085 Hz) than the Arabic speaker, whereas the duration was longer (2.8180 ms) than the Arabic speaker. For imperative utterance, the initial duration of the Arabic speaker was higher than the Indonesian learners (466.532), whereas the final duration of the Indonesian learners was higher (203.895) than the Arabic speakers and the low duration of the Arabic speakers was lower (111.612) than the Indonesian learners and longer in terms of tempo than the Indonesian learners (2.6922 ms).

Keywords: acoustic features, target utterances, low duration, Arabic speakers, Indonesian learners

I. Introduction

This paper is based on a research finding on acoustic duration of the Arabic utterances produced by four Indonesian learners of Arabic in Al Washliyah University Medan in 2013. The researcher conducted a research on Indonesian learners in studying Arabic acoustic phonetic features. It aims at analyzing the duration of the Indonesian learners' utterances when pronouncing three target modes of Arabic utterances and then comparing them with the utterances pronounced by the native speaker of Arabic. Phonetics studies about sounds that reflexes articulate, acoustic and the perceptual of language phenomena. It has a significant role in the context of language learning, since phonetics as science describes the process of sounds produced by a speaker of a language until it reaches the listener who receives meaningful information. The importance of phonetics theory and concept provides methodology and approach to analyze language sounds of Arabic.

The acoustic approach is used to describe on the physical duration components of the uttered sounds. The experimental phonetics study is applied to visualize some aspects of the speech event and to provide a basis for measurements. According to Lehiste (1970:125), duration can be associated with the terms of quantity if it functions as free variable of a language phonology system. If the segment is in the form of a sentence, the range of time is called tempo. As a period of time articulatory and time dimension of acoustic signal, the range of time required to produce a sound segment is measured in millisecond unit. Furthermore, Van Heuven (1994) states that duration as temporal structure is a set of regulation that determines duration formation in producing sounds of utterances. Duration is a single cycle called period. Period is always represented by symbol T and is measured in every second or millisecond (one per million seconds), which is abbreviated "md". This term shows that the counting of open and close of a sound tape is a period in one second. That condition directly connects to the frequency of the sound wave.

The significance point in researching the duration in Arabic language learning has connection with the determination of articulatory movement and its measured connections in uttering similar sounds of Arabic

language. The Indonesian learners of Arabic have difficulties in terms of duration of sound segment, therefore, the focus of the study should be on the phonetic acoustic experimental study. The first reason is determined by the character of the segment itself, namely by the point and the character of articulation, and the second reason is determined by the quality of its phonetic characteristics. This research has theoretical and practical contributions. Theoretically, it becomes the parameter of the existing factual verbal sound modes and the codification of the verbal features in terms of duration of the Indonesian learners of Arabic language as a clear reference in the acoustic sound realization to those who want to know and study the language. Practically, the findings are due to the parameter for the teaching of sound system of Arabic language in the future and the experimental acoustic phonetics study of Arabic language used by the Indonesian students in Medan.

II. Review of literature

Some researches on supra-segmental that related to this study have been conducted previously. Bahjat (2010) Faculty of Letters, Ti'rīn University, in his dissertation title "أثر الصوانت في دلالة البني الصرفية في اللغة العربية" (aṯaru al 'awāiti fī dilālāti al binniy al 'arfiyati fī al luḡati al 'arabiyati) describes about the influence of Arabic sounds toward formation of word structure in morphology and syntax. In fact, the focus of this study is on utterance of sound beginning from the change of word structure that happens at the middle or at the end of the word. The result of his research stresses more on the function of Arabic sounds not on the character of language itself. He criticizes former Arabic linguists a lot because they had conducted a lot of studies about consonant sound only, but ignored studies on sound changes. His research has concluded his finding on terms of sound in the fields phonetics such as; al a'wāt al laiyyin, al a'wāt al mutaharrikah, dan al a'wāt al 'alīqah.

Zalaqi (2009) in his research entitled "Bunyi Konsonan Bahasa Arab Fusha" conducted a laboratory research on sound system in Arabic. The studies that he conducted covered four levels of Arabic system, namely, sound level, phoneme structure level (morphology), sentence structure level (Syntax) and word meaning level. In his research, he strongly paid attention on soft and hard sounds in Arabic consonant sounds and the sound that has a very close link with psychological and physical effect.

Syarfina's research (2008) found that there was the acoustic characteristics distinction at the social structure in Melayu Deli community. It showed that the utterances of social language group of Melayu Deli was adjusted to the social group and the distinction among them are clearly different in their interaction in the forms of giving order, asking question and giving information. Another acoustic research was conducted by Ebing (1997). It proved that utterance in Indonesian language there is no distinction of melody contour rightly. He uses three main components in his research namely; accent, dominant parts of certain utterance, segmentation of utterance which is used to help listener determines syntaxes structure of utterance he hears and qualification of information in certain utterance. To achieve his objective, Ebing has conducted three experiments that were focused on function of tone current accentuation, while the second and the third experiments were focused on function of accent intersection and border marks of current tone.

III. Method

In this research, the experimental method was used to determine the acoustic characteristic and sociolinguistic variation. The acoustic characteristics are the duration of the speech utterances and the sociolinguistic variations is based on sex (male and female speakers). The selection of female and male sexes was to describe the difference of duration of the sound utterances that produced by male and female speakers. The selection of the Arabic native speaker as the informant was due to the validation of the Arabic sounds.

3.1 Technique of Data Collecting

Respondents of this study were five speakers (the utterances of two male Indonesian learners, two female Indonesian learners who studied at Al Washliyah University Medan and one Arabic native speaker from Saudi Arab who is a teacher at Ma'hat Al Sunnah). The students are aged between eighteen to twenty years old and they are able to articulate the Arabic sounds at the intermediate level whereas the teacher is twenty six years old.

The data in this research was collected in 2013 by recording the MSL utterances in three modes, namely declarative, interrogative, and imperative modes. Data could not be obtained naturally due to the recording device which eliminated the neutrality of data. In order to avoid biased data, the data was filtered using a narrative (using a carrier sentence). The respondents were given a narrative and then asked to express the utterances in declarative, interrogative, and imperative modes. The respondents were conditioned to utter a particular utterance and the data was then recorded by using a recorder a SONY Stereo Cassette Corder WM-D6C along with a Head Set Mic SHURE Model SM10A. The target sentence was chosen at random taken from daily practice of Arabic sentences and there were no certain criteria used for selecting or determining the target sentence. To test whether the research subjects could be accepted as the utterances intended by the researcher,

instrument validation was conducted. Validation was done by comparing the duration of the Indonesian learners of Arabic with the native speaker of Arabic.

3.2 Technique of Data Processing

After having collected the data, the collected data was processed using a computer program called Praat version 4.0.27. This program measured the duration of each utterance. In data processing, data of segmentation was performed on single segments which formed an utterance, followed by calculating the duration of the single segments or the vowel differences measured in milliseconds (ms). The purpose was simply to distinguish the temporal features of declarative, interrogative, and imperative utterances. Segmentation results were stored in TextGrid files.

3.3 Technique of Transcription

This research used the system of sound symbols of International Phonetic Alphabet notation which has been revised and corrected in 1996 and that make use of the modifications basic symbols known as diacritics such as γ , ζ .

IV. Experiment

4.1 Primary Contour

In this experiment, three utterances that were produced by the five speakers (the utterances of two male Indonesian learners, two female Indonesian learners and one Arabic native speaker) were used as the target utterances. The experiment measured the tonic contour and format utterances were distilled. They were recorded and digitized in the form of graphic seen below. Duration has four degrees of extra short, short, half-long and long. Have a look at the experiment results found in declarative, interrogative and imperative modes in the following graphs and explanations. The three graphics below showed the contrasts prosodic features between long and short duration that were uttered by male and female Indonesian Arabic learners. In English vowels are higher in pitch following voiceless consonants than following voiced consonants. Vowels are longer before voiced consonants than before voiceless consonants.

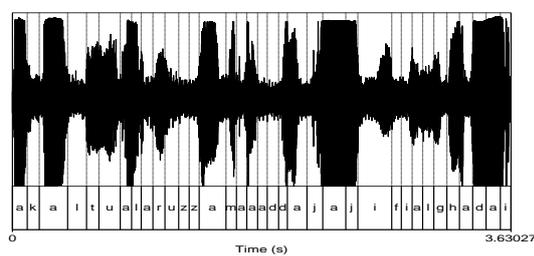
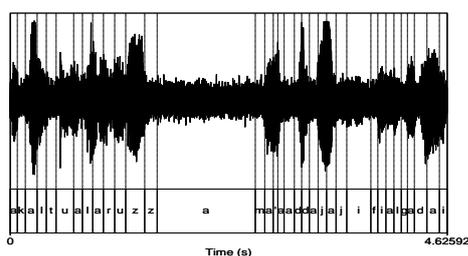


Figure 1. Duration of male declarative utterance
“akaltu alaruzza maʕa al dajāji fi al ʔadāi”

Figure 2. Duration of female declarative utterance
“akaltu alaruzza maʕa al dajāji fi al ʔadāi”

Female utterances are marked by the first wavy lines and male ones are shown in the second lines. Meanwhile, the vertical lines tell the average nominal utterances in milliseconds. The figure below describes that there is a difference in time span of vocal speeches between males and females.

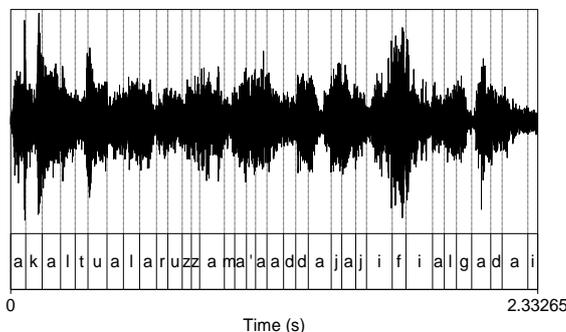


Figure 3. Duration of Arabic declarative utterance

“akaltu alaruzza maʿa al dajāji fi al yaḍāi”

Fig. 1 above shows akaltu alaruzza maʿa al dajāji fi al yaḍāi that consists of six sounds and the duration of male utterance can be explained as follows: akaltu (0,68 md), al aruzza (1,92 md), maʿa (0,31 md), al dajāji (0,92 md), fi (0,16 md), al yaḍāi (0,63 md), where the total duration is 4,63 md. Graph 2 shows the duration for female utterance: akaltu (0,80 md), al aruzza (0,76 md), maʿa (0,25 md), al dajāji (0,96 md), fi (0,15 md), al yaḍāi (0,71 md). The total duration is 3,63 md. Duration for Arabic utterance shows the following: akaltu (0,44 md), al aruzza (0,52 md), maʿa (0,19 md), al dajā ji (0,55 md), fi (0,18 md), al yaḍāi (0,46 md). The total duration is 2,33 md. The overall duration shown in Graph 3 are: akaltu (0,52 md), al aruzza (0,72 md), maʿa (0,21 md), al dajāji (0,53 md), fi (0,12 md), al yaḍāi (0,56 md), and the total duration is 2,66 md.

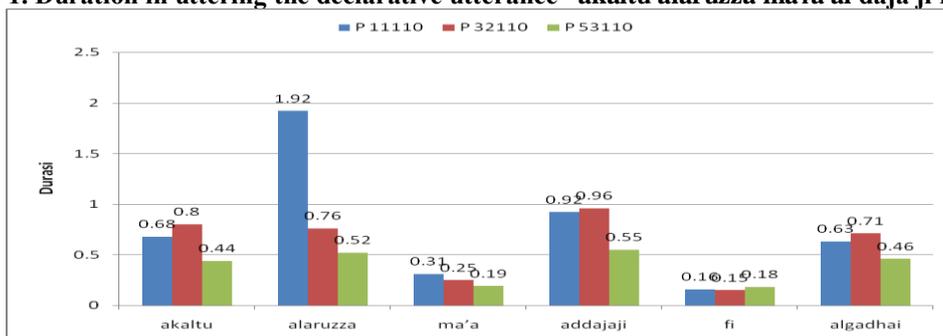
Each sound depicts a different duration of utterance. By comparing the three utterances, it is found that the longest duration of uttering the sound akaltu is pronounced by female speaker, while the shortest one is by an Arabic speaker. The duration of uttering al aruzza, the longest one is pronounced by male and the shortest one is by the Arabic native speaker. The duration of uttering maʿa resulted that the longest one is by male and the shortest one is by an Arabic native speaker. Longest duration of uttering al dajāji is by female and the shortest one is by an Arabic native speaker. For the word fi, the longest duration is by female and the shortest one is by an Arabic native speaker. Finally, the longest duration al yaḍāi is also by female and the shortest one is by an Arabic native speaker. Referring to the information above, it can be concluded that the longest duration of utterance is by male and the shortest one is by an Arabic native speaker.

Having analyzed the duration of utterances produced by females and males such as Udin ondak pogi ke laut 'Udin wants to go the sea' it is concluded that there is dissimilarity of vowels. The significant differences might happen to the vowels in the second syllables, for instance, Udin, the vowel [a] uttered by females is 0,19 md and by males is 0,11 md; these mean that females produce longer speech, that is 0.8 md, than males do. It is also found that there are the following vowels, such as a, e, u, a, and i, among males and females. The highest differences occur in the last syllables, for example the vowels a and u, produced by females at about (0,13 and 0,12 md), and by males at around (0,9 dan 0,8 md) in which the difference is about 0,4 md. These mean that there is significant dissimilarity of vowels between females and males. Female utterances are higher than males are, especially, in the vowel [u] which appears in the beginning of the speech.

Having analysed the utterance Bilu Udin ondak pogi ke laut 'When does Udin want to go to the sea?' which is produced by males and females, the result is that there is a difference of duration in the vowel production. The significant dissimilarity relates to vowel [e] being spoken by females at around (0,09 md), and by males at about (0,06 md); moreover, the values for vowels [a] and [u] are close to (0,12 and 0,0,11md), and (0,09 and 0,08 md) respectively. Fig. 4 above displays that there is a difference of duration in the beginning, middle, and final of the complete speech. After analysing the duration of the speech Udin pogilah ke laut sekarang spoken by females and males the result shows that there is a difference of duration in the initial, medial, and final syllables. Such an utterance above, having been analysed, shows a difference of duration in the vowel of the initial syllable. This syllable also stresses that the vowel [u] is prolonged by females at around (0,14 md) and by males at about (0,10 md); however, the vowel [e] which is uttered by females reaches at (0,12 md) and by males at (0,06 md).

The Fig. 4 shows the duration of vowels in the declarative, interrogative, and imperative utterances. Time span of the last vowel tend to be longer than the time span of the preceding vowels. Otherwise the length of the last syllable the length seems to happen at the declarative, interrogative, and imperative contours. As a result, the duration among the females is longer than among the males when these men pronounce the declarative, interrogative, and imperative sentences. contours. Fig. 4 below shows the duration in uttering the declarative utterance “akaltu alaruzza maʿa al dajā ji fi al yaḍāi, graphs 6, 7, and 8 shows the duration of the interrogative utterances “matā yaḍhabu aḥmad ilā al sūqi” that are produced by a male, a female and an Arabic native speakers.

TABLE 1. Duration in uttering the declarative utterance “akaltu alaruzza maʿa al dajā ji fi al yaḍāi



Based on Table 1, the duration of utterance by male is as follows: matā (0,39 md), yaḏhabu (0,65 md), aḥmad (0,46 md), ilā (0,34 md), al sūqī (0,55 md). The total duration is 2,58 md. Moreover, the duration of female utterance is as follows: matā (0,69 md), yaḏhabu (0,57 md), aḥmad (0,46 md), ilā (0,42 md), al sūqī (0,47 md). The total duration is 2,81 md. Lastly, we can see the duration of an Arabic native speaker are: matā (0,26 md), yaḏhabu (0,44 md), aḥmad (0,33 md), ilā (0,32 md), al sūqī (0,44 md). The total duration for all utterances is 1,77 md. From the information shown in the Table 1, it is found that female learners produce the longest duration of “matā yaḏhabu aḥmad ilā al sūqī” compared to male learners, whereas the Arabic native speakers produced the shortest duration. Therefore, in terms of duration in uttering matā, the longest one is when it is uttered by female and the shortest one is by Arabic native speakers.

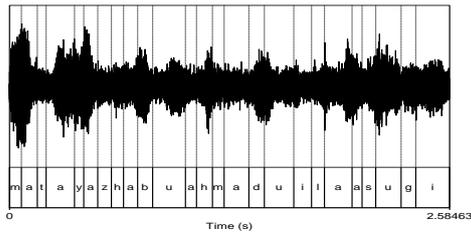


Figure 4. Duration of Male Speaker

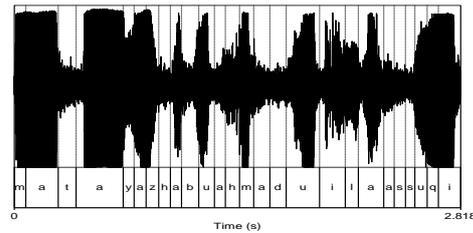


Figure 5. Duration of Female Speaker

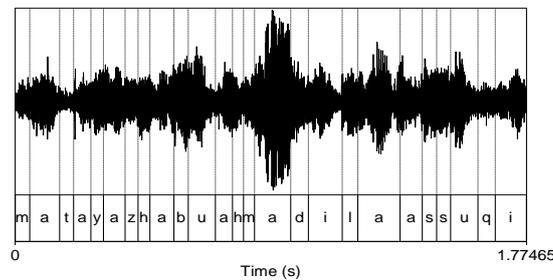
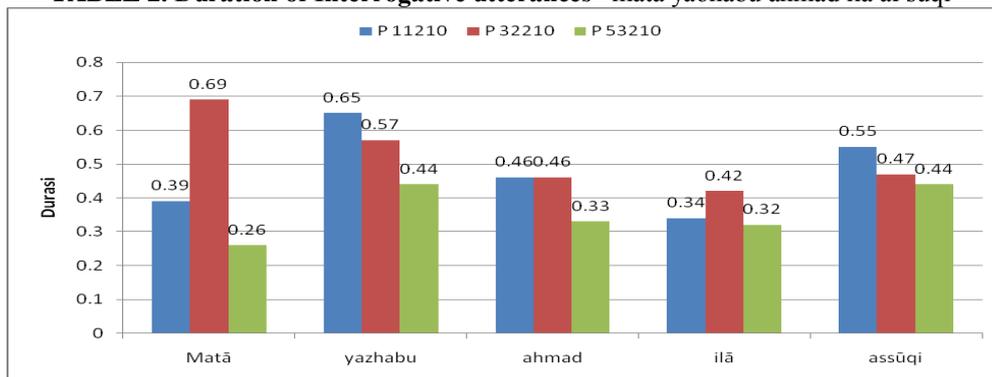


Figure 6. Duration of Arabic Native Speaker

The duration of uttering the word yaḏhabu, the longest one was when it was uttered by male and the shortest one is by Arabic native speaker. Duration of uttering the word aḥmad, the longest one is when it is uttered by female and male, and the shortest one is by Arabic native speaker. Duration of uttering ilā, the longest one is when is uttered by female and the shortest one is by Arabic native speaker. Duration of uttering al sūqī, the longest one is when it is uttered by male and the shortest one is by Arabic native speaker. The following graph showed the duration of Interrogative utterances “matā yaḏhabu aḥmad ilā al sūqī”

TABLE 2. Duration of Interrogative utterances “matā yaḏhabu aḥmad ilā al sūqī”



The following graphs showed that duration for male to utter the sounds: ḫuḏ (0,34 md), hāḏā (0,35 md), al kitāba (0,87 md), yā (0,48 md), ṣuḏmān (0,63 md) with the total duration of 2,69 md. Duration for female word utterances are: ḫuḏ (0,32 md), hāḏā (0,40 md), al kitāba (0,70 md), ya (0,40 md), ṣuḏmān (0,60 md). The total duration is 2,44 md. As for an Arabic native speaker, the duration are as follows: ḫuḏ (0,28 md), hāḏā (0,24 md), al kitāba (0,54 md), yā (0,20 md), ṣuḏmān (0,45 md), with the total of 1,69 md.

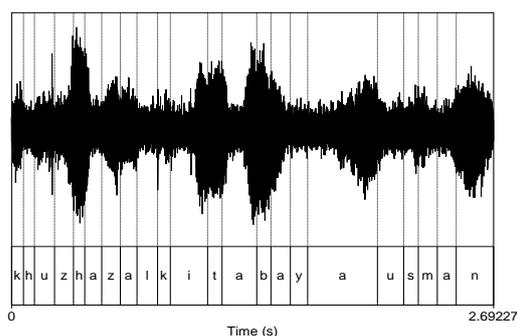


Figure 7. Duration of utterance by Male

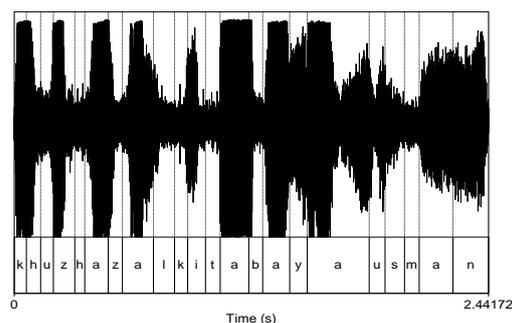


Figure 8. Duration of utterance by Female

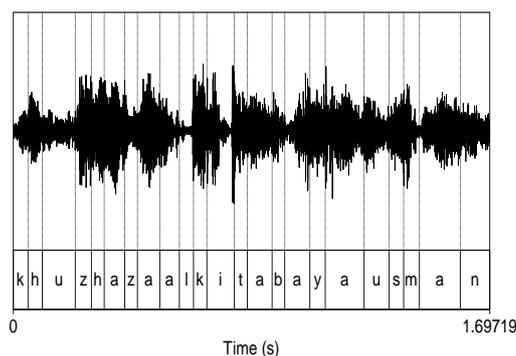
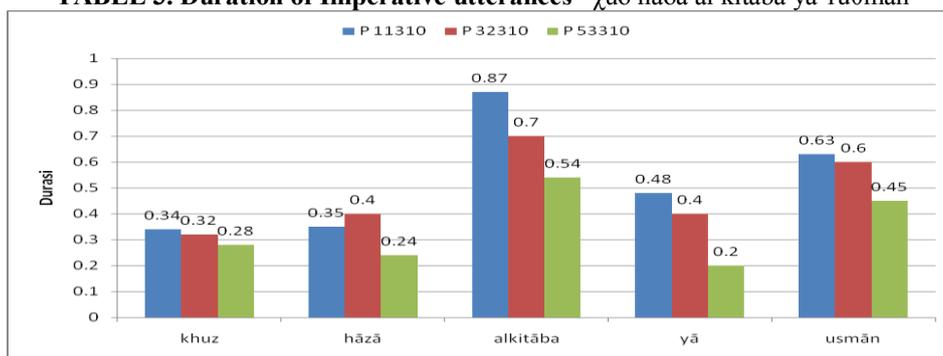


Figure 9. Duration of utterance by Arab Native Speaker

Referring to the graphs above, it can be seen that for the utterance: $\text{ḥuḍ hāḍā al kitāba yā ṣuṡmān}$, the longest duration is uttered by a male and the shortest one is uttered by an Arabic native speaker. Moreover, duration for the sound ḥuḍ , male had the longest duration, while the Arabic native speaker had the shortest duration. However, duration in uttering hāḍā , the longest duration is by female and the shortest one is by Arabic native speaker. Graph 1 shows the duration of male utterance as follows: akaltu (0,68 md). It is found that the longest duration of uttering the sound akaltu , is by female speaker, while the shortest one is by an Arabic speaker. The duration of uttering al aruzza , the longest one is by male and the shortest one is by an Arabic native speaker. al aruzza (1,92 md), while the duration of uttering maṣa resulted that the longest one is by male and the shortest one is by an Arabic native speaker. maṣa (0,31 md). al dajāji (0,92 md), Longest duration of uttering al dajāji is by female and the shortest one is by an Arabic native speaker.

The duration of fi is 0,16 md, the longest duration is by female and the shortest one is by an Arabic native speaker. al yaḍāi (0,63 md), where the total duration is 4,63 md. Finally, the longest duration al yaḍāi is also by female and the shortest one is by an Arabic native speaker. Graph 4 below shows the duration in uttering the declarative utterance “ $\text{akaltu alaruzza maṣa al dajā ji fi al yaḍāi}$, : akaltu (0,80 md), al aruzza (0,76 md), maṣa (0,25 md), al dajāji (0,96 md), fi (0,15 md), al yaḍāi (0,71 md). graphs 6, 7, and 8 shows the duration of the Interrogative utterances “ $\text{matā yaḍhabu aḥmad ilā al sūqi}$ ” that are produced by a male, a female and an Arabic native speakers. Graph 2 shows the duration for female utterance The total duration is 3,63 md. Duration for Arabic utterance shows the following: akaltu (0,44 md), al aruzza (0,52 md), maṣa (0,19 md), al dajā ji (0,55 md), fi (0,18 md), al yaḍāi (0,46 md). The total duration is 2,33 md. The overall duration shown in Graph 3 are: akaltu (0,52 md), al aruzza (0,72 md), maṣa (0,21 md), al dajāji (0,53 md), fi (0,12 md), al yaḍāi (0,56 md), and the total duration is 2,66 md.

Referring to the information above, it can be concluded that the longest duration of utterance is by male and the shortest one is by an Arabic native speaker. Based on the graphs, the duration of male utterance is as follows: matā (0,39 md), yaḍhabu (0,65 md), aḥmad (0,46 md), ilā (0,34 md), al sūqi (0,55 md). The total duration is 2,58 md. Moreover, the duration of female utterance is as follows: matā (0,69 md), yaḍhabu (0,57 md), aḥmad (0,46 md), ilā (0,42 md), al sūqi (0,47 md). The total duration is 2,81 md. Lastly, we can see the duration of an Arabic native speaker are: matā (0,26 md), yaḍhabu (0,44 md), aḥmad (0,33 md), ilā (0,32 md), al sūqi (0,44 md). The total duration for all utterances is 1,77 md.

TABLE 3. Duration of Imperative utterances “ $\chi u\delta$ hāḏā al kitāba yā $\zeta u\theta m\bar{a}n$ ”

Duration in uttering al kitāba, the longest one is by male and the shortest one is by Arabic native speaker. Duration in uttering yā, the longest one is by male and the shortest one is by Arabic native speaker. Duration for the word $\zeta u\theta m\bar{a}n$, the longest one is by male and the shortest one is by Arabic native speaker.

V. Findings

The prosodic features of “akaltu alaruzza maṣa al dajā ji fi al yaḏāi” has different sound duration. After having done the analysis of data, the findings showed that the male-female Indonesian learners’ prosodic features of duration in uttering the same target utterance were different with the native Arabic speaker. The different duration in producing the same utterances is not surprising. The reason is due to differences in their properties of their place and manner of articulations. When the Arabic vowels are in the middle position pronounced with voicing or voiceless consonants, for examples when vowels meet velar-fricative, velar-pharyngeal, alveolar-plosive, alveolar-fricative, and labiodentals-fricative sounds, the Indonesian learners try to adapt with their own similar sounds because they could not find those sounds in Indonesian language like plosive velar, alveolar fricative, glottal stop or alveolar fricative.

In comparing three different utterances mode, it was found that the longest duration of uttering akaltu was by female and the shortest one was by the Arabic native speaker. The longest duration was when al aruzza was pronounced by male and the shortest one was pronounced by the Arabic native speaker. Subsequently, the longest duration of utterance when pronouncing maṣa by the male and the shortest one was by the Arabic native speaker. The longest duration of utterance when pronouncing al dajā ji was when it was uttered by female and the shortest one was by Arabic native speaker. The longest duration of utterance when pronouncing fi was when it was uttered by female and the shortest one was by Arabic native speaker. Lastly, the longest duration of utterance when pronouncing al yaḏāi was when it was uttered by female and the shortest one was by Arabic native speaker.

For the utterance “matā yaḏhabu aḥmad ilā al sūqi”, it was found that the Arabic native speaker had the shortest duration comparing to female speakers who had the longest duration in uttering the sounds. The longest duration of utterance when pronouncing matā uttered by female speakers was longer and the shortest one is by the Arabic native speaker. In uttering yaḏhabu, the duration male speakers was significantly on the contrary. It was longer than one which was uttered by the Arabic native speaker. The longest duration of utterance when pronouncing aḥmad was when it is uttered by female and male, and the shortest one was by Arabic native speaker. The longest duration of utterance when pronouncing ila was when it was uttered by female and the shortest one by Arabic native speaker. The longest duration of utterance al sūqi was uttered by male and the shortest one by Arabic native speaker.

In the utterance “ $\chi u\delta$ hāḏā al kitāba yā $\zeta u\theta m\bar{a}n$ ”, it was found that the longest duration in pronouncing the phrase was when it was uttered by male and the shortest one was by Arabic native speaker. The longest duration of utterance when pronouncing $\chi u\delta$ by male and the shortest one was by the Arabic native speaker. On the contrary, the longest duration when pronouncing hāḏā, by the female and the shortest one was by the Arabic native speaker. However, for the duration of al kitāba, the word yā and $\zeta u\theta m\bar{a}n$ was the longest when it is uttered by male and shortest by Arabic native speaker. From the information shown in the graphs, it is found that female produce the longest duration of “matā yaḏhabu aḥmad ilā al sūqi” compared to a male and the native Arabic speakers, whereas the Arabic native speaker produced the shortest duration. Therefore, in terms of duration in uttering matā, the longest one is when it is uttered by female and the shortest one is by Arabic native speaker.

VI. Conclusion

Based on the research outcomes of the three types of sentences produced in three different utterances and variety of respondents, it is concluded that the duration is longer when uttering the sounds by male and the shortest one is by Arabic native speaker and the duration of utterance is shorter when it is uttered by Arabic native speakers than it is by Indonesian speakers.

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