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# An Acoustic Analysis of Penang Malay Monophthongs Among the Jawi Peranakan Community

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## ABSTRACT

This study examines the acoustic features of the monophthongs of Penang Malay (PM) based on the frequencies of the first (F1) and second (F2) formants as produced by five selected female speakers who are of the Jawi Peranakan (JP) community in Penang, Malaysia. This study is significant as it describes the monophthongs of PM because previous studies have focused on the acoustic analysis of Standard Malay (SM) and analyzed PM from impressionistic and phonological aspects. The target vowels are [a], [i], [u], [ɛ], [ɔ], [ə], [e], and [o]. A series of words were used to elicit data from the speakers. The tokens produced by the speakers were recorded and analyzed using Praat version 6.0.50. The two formants were analyzed using the Formant Frequency Model, and independent samples *t*-tests were conducted. The findings reveal that the PM participants mostly produced vowels following impressionistic studies of past researchers. However, PM speakers did not distinguish between [ɛ] and [e] as the sounds were conflated as one vowel. These results challenge past claims of homogeneity between PM and Kedah Malay (KM). This study expands knowledge on PM's phonetics and highlights avenues for future research.

*Keywords*: Acoustic analysis, Formant Frequency Model, monophthongs, Penang Malay

## INTRODUCTION

Malaysia is a multi-ethnic and multilingual country with about 32.69 million inhabitants (Department of Statistics Malaysia, 2020). It is geographically divided into West Malaysia and East Malaysia. As a multilingual and multi-ethnic country, Malaysia has around 140 historical languages (Lewis et al., 2016). According to Omar (1985), the dialects found in Peninsular Malaysia

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have been grouped into seven main areas, namely the Northwestern dialect, also known as the Northern Dialect or Kedah Dialect (covering Kedah, Perlis, Penang, and north of Perak), Perak Dialect (covering the center of Perak), Southern Dialect (covering the south of Perak, Johor, Melaka, and Selangor), Kelantan Dialect (covering the Kelantan state and the borders of Pahang and Terengganu), Terengganu Dialect, Pahang Dialect and lastly Negeri Sembilan dialect. In this study, Penang Malay (henceforth PM), which belongs to the Northern Malay Dialect, will be of focus, and the objective of the study is to analyze the acoustic features of the monophthongs of PM based on the frequencies of the first (F1) and second (F2) formants.

Linguistically, native speakers of Malay in Penang speak a subdialect of Kedah (Omar, 1985, 1993, 2015). Kedah Malay (henceforth KM), or Kedah Malay Dialect, is a dialect with unique properties, and it is spoken from Perlis down to the north of Perak (Omar, 2015). Even though Perlis and Penang (the Island and Seberang Perai) are the states that have their governance in the Constitution of Malaysia, historically, they were part of Kedah. In 1786, Penang ceded to the British East India Company in exchange for military protection from Burmese and Siamese armies who were threatening Kedah then. Seberang Perai followed suit in 1800.

Omar (2015) argues that the Penang subdialect is the variety found and spoken on the island. The subdialect spoken in Seberang Perai is part of the Kedah Persisiran (henceforth KP) subdialect. On the notion of PM, if it is analyzed carefully, it can be further divided into two other subdialects: Balik Pulau (hereafter BP) and Tanjung (present-day Georgetown) subdialects. The main difference lies in producing prevocalic and intervocalic /r/. In the BP subdialect, it is produced as a uvular fricative [ʁ], while in the Tanjung subdialect, it is produced as a velar fricative [ɣ].

Radzi et al. (2018) have also noted that different variations of PM resulted from cultural and artistic influences. In the present discussion on dialectology, Rahim (2015) has also characterized PM as *Bahasa Tanjong* (Tanjong language). *Bahasa Tanjong* emerged because of the language contact between two cultures: Malay and South Indian Muslims. Consequently, intermarriages between these two communities have produced an Indo-Malay community known as Jawi Peranakan (henceforth JP), the native speakers of PM (Rahim, 2015). Y. A. Merican (n.d.) argued that JP's dialect is harsher-sounding than Malay in the same locality.

Many researchers have studied the Northern Malay dialects because of their linguistic uniqueness (Ahmad, 1969; Collins, 1986; Omar, 1993; Radzi et al., 2018). Studies in dialectology have concentrated primarily on syntactic and sociolinguistic aspects (Ong et al., 2016). Regarding acoustic analyses of the Malay language, those performed on PM are scarce, as many studies are based only on Standard Malay (henceforth SM) (Hamid & Aman, 2010; Hamid et al., 2012). Ong

et al. (2016) have conducted a study on Penang subdialects from a phonological point of view; however, their study does not explicitly cover the acoustic properties of Penang subdialects. Research into Malay phonetics is still in its early stages. Only several studies have analyzed the vowels in Malay dialects, namely Perlis, Kelantan, Terengganu, and Kedah, instrumentally (see Azli, 2017; Jamil et al., 2019).

This study is of significance as it describes the acoustic properties of monophthongs of PM using the Formant Frequency Model because previous studies have focused on SM's acoustic analysis and analyzed PM from impressionistic and phonological aspects.

## Literature Review

**Characteristics of Standard Malay.** Malay is the native language in Peninsula Malaysia and surrounding areas, including Singapore and southern Thailand, central and eastern Sumatra, Riau Islands to the west coast of the island of Borneo (Omar, 2005). Previous studies, as done by Maris (1980), Onn (1980), Dain (1985), Karim (1989), Teoh (1994), and others, described the nature of the vowel sounds of SM (i.e., [i, e, a, o, u, ə]) through the impressionistic approach. Zahid and Omar (2012) have proposed the same set of vowels with the addition of three vowels: [ɛ], [ɔ], and [ɒ]. These studies described the vowel sounds without distinguishing the production of vowel sounds by gender, and they have led researchers to have varying opinions on the vowel sounds of Malay. The literature generally agrees that men and women have different vowel-specific formant patterns (Bradley, 2018; Leung et al., 2020; Maurer & Suter, 2015; Weirich & Simpson, 2014). Figure 1 shows the traditional diagram Maris (1980) developed to illustrate the approximate tongue positions during the production of the vowels.

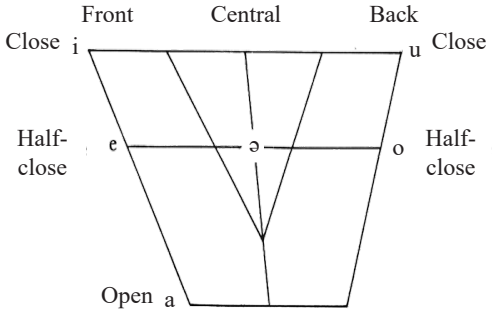


*Figure 1*. Diagram of pure vowels in Standard Malay (Maris, 1980)

In what can be called the standard pronunciation of Malay, there are six pure vowels, i.e., [i, e, a, o, u, ə]. Maris (1980) used the following terms in defining them: front, back, and central, depending on which part of the tongue is raised in the mouth; close, half-close, and open, depending on the distance between the related parts of the raised tongue and the palate; rounded and unrounded, depending on the location of the lips, i.e., the presence or absence of lip-rounding during the production of the vowel sounds. The front and central vowels in Malay are always unrounded, while the vowels in the back are always rounded.

**Characteristics of Penang Malay.** Omar (2015) stated that there are eight vowels in

KP, the standard subdialect of Kedah. The vowels are /a/, /i/, /u/, /ɛ/, /ɔ/, /ə/, /e/, and /o/. PM has the same set of vowels as PM is part of KM. She has divided the KM dialect into several subdialects, particularly Perlis-Pulau Langkawi, Kedah Persisiran, Kedah Utara, and Penang. Omar (1993) has also divided the KM dialect into five subregions:

1. Perlis
2. Langkawi Island
3. Lembah Kedah-Seberang Perai, covering Kubang Pasu to Bandar Baharu, and the northern part from the west coast to Baling
4. The border of Padang Besar to the east and south, which covers Padang Terap and Sik
5. Penang (the island itself)

Ismail (1971) divided KM into three main divisions. According to him, in the northern area, near the Malaysia-Thailand border, KM is influenced by Thai, especially regarding pronunciation. This dialect is best known as the KM dialect with a Siamese twist. In the eastern part, a variation of KM is comparable to that of Kelantanese Malay, known as the KM dialect with a Pattani twist. Meanwhile, KM is less influenced by the Thai or Pattani dialect on the coastline, which covers the lowland (including Penang Island). Speakers of Malay in this area speak more neutrally than speakers of other Malay varieties in the districts mentioned earlier. The Malay dialect in this area is known as the "Kedah language" (Ismail, 1971). Hussein (1973) affirmed that KM stretches the whole north-western coast of the Peninsula from the south of Perlis to Dinding in Perak, including Penang Island. Collins (1986), on the other hand, argues that the classification of KM includes the coasts and islands of three countries: Malaysia, Indonesia, and Thailand.

Even though PM is classified as part of KM, the features and properties of PM are not always similar to KM. This phenomenon is acknowledged by Omar (1979):

A dialect area need not necessarily be uniform throughout. It is impossible to expect a space covering several thousand square miles to show uniformity at any single level of the language system. There are bound to be differences at a lower level of the system, particularly at the level of phonology, between the speech of one district and that of another. (p. 5)

According to Omar (2015), the first significant difference between BP and Tanjung subdialects lies in the production of prevocalic /r/ and intervocalic /r/. In the BP subdialect, the production of /r/ is uvular fricative [ʁ], identical to that of KP. The production of /r/ in the Tanjung subdialect is velar fricative [ɣ] as found in the Southern dialects. However, there could be two variations of /r/ among Tanjung speakers, some may use the velar fricative [ɣ], and some may use the alveolar trill [r]. Table 1 shows the prevocalic and intervocalic /r/ in BP and Tanjung subdialects.

The second difference between these two subdialects can be seen in the word-final vowel /a/. In this instance, the Tanjung subdialect shows a similarity in the sound

production as that of KP, which is low-mid and lips are stretched in producing the sound. In the BP subdialect, however, the word-final vowel /a/ is produced as a back vowel, and the lips are a bit rounded in producing the sound. Table 2 shows the word-final vowel of /a/ in Tanjung and BP subdialects.

Table 1
*Prevocalic and intervocalic /r/ in Balik Pulau and Tanjung subdialects*

| Tanjung | Balik Pulau/Kedah Persisiran | Standard Malay | English translation |
|---|---|---|---|
| [buɣoʔ̃] | [buʁoʔ̃] | *buruk* | ugly |
| [ɣibot] | [ʁibot] | *ribut* | storm |
| [maɣah] | [maʁah] | *marah* | angry |

*Note.* Adopted from Omar (2015)

Table 2
*Word-final vowel of /a/ in Tanjung and Balik Pulau subdialects*

| Tanjung | Balik Pulau/Kedah Persisiran | English translation |
|---|---|---|
| [apa] | [apɑ̣] | what |
| [dʒala] | [dʒalɑ̣] | fishing net |

*Note.* Adopted from Omar (2015)

On the other hand, Ong et al. (2016) conducted a study on the phonology of PM subdialect. Based on their acoustic analysis of BP participants, it is found that this subdialect is phonologically different as compared to the standard KM dialect. For example, differences include vowel deletion and nasal-obstruent assimilation. Vowel deletion also occurs in PM, but based on the findings of their study, the tendency for vowel deletion among the BP participants is not as significantly high as nasal-obstruent assimilation. Table 3 shows some examples of vowel deletion in PM.

Table 3
*Vowel deletion in PM*

| Standard Malay | Penang Malay | English translation |
|---|---|---|
| *lain* | [len] | different |
| *main* | [men] | play |
| *daun* | [don] | leaf |
| *jauh* | [dʒoh] | far |

*Note.* Adopted from Ong et al. (2016)

This process refers to the nasal and plosive consonants that are homogenized in terms of places of articulation, such as "m-p" and "m-b" ([kampuŋ], [lampu], [sɛmbaŋ], and [dʒampi]). Speakers of PM have acoustically highlighted some significant and unique differences with KM. Ong et al. (2016) have laid out the following examples in Table 4 to further illustrate the process of nasal-obstruent assimilation in Penang Malay.

Table 4
*Nasal-obstruent assimilation in PM*

| Standard Malay | Kedah Malay | Penang Malay | English translation |
|---|---|---|---|
| *mandi* | [mandi] | [mandi] | bathe |
| *tunggu* | [tuŋgu] | [tuŋgu] | wait |
| *cangkul* | [tʃaŋkoj] | [tʃaŋkoj] | shovel |
| *lembu* | [ləmmũ] / [ləmũ] | [lembu] | cow |
| *kambing* | [kambin] | [kambin] | goat |
| *tinggi* | [tiŋgi] / [tiŋi] | [tiŋgi] / [tiŋŋi] | tall/high |

*Note.* Adopted from Ong et al. (2016)

**Jawi Peranakan.** As this study explores the acoustic analysis of the monophthongs of PM as produced by the speakers of PM who are of JP origin, an overview of JP will be provided to understand this community better. The JP community has long existed in Penang, and some theories have even suggested that they have existed since the 1770s (Yusoff & Mohamed, 2010). According to A. M. Merican (2018), people who inhabited Penang in the late 1700s or the early 1800s were called "*orang Tanjong Penaga*" or "the people of Tanjong Penaga," and Tanjong Penaga was the name given to it earlier before it was changed to Georgetown, Penang. Today it is a multicultural island of people of different ethnicities; however, the Malay and JP communities were said to have explored Penang much earlier (Yusoff & Mohamed, 2010). In the Malay Archipelago, the JP is said to have existed since the seventh century, especially during the reign of Srivijaya. In addition, the JP was already in existence when Kedah became an essential port for trading routes between India and China, dating back to the third century (Eusoff, 1997). Thus, the assumption is that this is probably the beginning of the formation of the JP community in Malaya (Yusoff & Mohamed, 2010). The opening of a trading port in Penang by the British boosted the arrival of this community from Kedah to Penang, which continued until the 17th century (Eusoff, 1997).

On the notion of terms, *Jawi Pekan* (henceforth JPn) refers to the community formed as a result of mixed marriages between migrants and traders from outside the country with local Malay women (Crawfurd, 1820; A. M. Merican, 2018).

Winstedt (1935) explains, "Indian Muslims have married the children of the Sultan and Treasurer in Melaka" (p. 18). In the 18th century Penang, this community had settled in urban areas; therefore, the British government used the term JPn to distinguish between foreigners or non-Malay Muslims who lived in the city and the Malay Muslims who lived in rural areas (Crawfurd, 1820). However, JPn is a rather vague term concerning its meaning. The term JPn was not only used to refer to Malays of mixed Arab, Indian, Bengali, Punjabi, Gujarati, Afghan, and Indian Muslims (both parents were Indian Muslims) who were born in Malaya and have gone through the process of assimilation into the Malay culture but the term was also used to refer to any person who is not a descendant of the local Malay community (Nasution, 2002). The ambiguity of this definition has made it difficult and challenging for scholars to provide the exact meaning of JPn (Crawfurd, 1820). However, starting from 1870, JPn was no longer used in the Annual Report of the Straits Settlements, and the term was replaced by JP, which is a reference to the Malays of mixed heritage (Arab, Indian, Bengali, Punjabi, Gujarati, and Afghan; Mahmud, 1972; A. M. Merican, 2018; Vaughan, 1857).

The definition by Mahmud (1972) shows that JP is a more specific term to refer to-Malays of mixed heritage (Arab, Indian, Bengali, Punjabi, Gujarati, and Afghan). The term JP was first used in 1871, and it no longer acknowledged or defined Indian Muslims who were born in Malaya to Indian Muslim parents and have taken on the Malay culture or any groups of Muslims who did not have a local Malay origin as JP. These changes were implemented to facilitate the division of groups in the Annual Report of the Straits Settlements (Nasution, 2002). In Singapore, this community is commonly known as JP, while in Melaka, they are known as *Peranakan Keling*. Table 5 shows several examples of Tamil words used in *Bahasa Tanjong*.

Table 5
*Examples of some Tamil words in Bahasa Tanjong*

| Tamil word | Meaning in *Bahasa Tanjong* |
|---|---|
| *achi* | older sister |
| *aniayom* | problem/difficulty |
| *atta* | father |
| *auta* | bluff |
| *karipullai* | curry leaves |
| *karpayi* | dark-skinned |
| *kacra* | dirty |
| *kerke* | crazy/mad |
| *korunggu* | monkey |

*Note.* Adopted from Rahim (2015)

The previous examples of words represent the influence of the Tamil language in the dialect spoken daily among the JP community. Since the JP are of mixed heritage, there is some form of influence from their mother tongue, Tamil, in their spoken Malay (Yusoff & Mohamed, 2010). This influence may be somewhat apparent for the early generations of JP, but the influence of Tamil on the PM dialect is rather subtle for later generations. According to Yusoff and Mohamed (2010), one of the main causes of Tamil's influence on PM is the direct interference between the two languages. *Bahasa Tanjong* has been

described as a "pidgin language that has become the mother tongue of a community" or "a creole that is a contact language" (Crystal, 2003, p. 346). The idea that *Bahasa Tanjong* is a creole may have originated from the fact that many different linguistic groups of speakers used it to communicate in early Penang. Considering that the diverse immigrant community in George Town spoke Malay as a common language, a pidgin language emerged among them was a possibility. It is incorrect to claim that the form is *Bahasa Tanjong*, though, as *Bahasa Tanjong* is a stable Northern Malay dialect and the native tongue of a specific Malay community, unlike a creole, which has its roots in a pidginized variety (Rahim, 2015). Archival evidence shows intermarriage between Indian Muslim settlers and local women and the emergence of the hybrid community that occurred even before the arrival of the British in Penang further disproves the claim that *Bahasa Tanjong* is a creole. It indicates that the community's language predates both the cosmopolitan George Town's existence and the British colonization of Penang.

## METHODOLOGY

### Participants

For this study, five PM speakers in the age range of 50-60 were selected. There were difficulties in getting more participants in that age range residing in the chosen area, and most were unavailable during the data collection process. All of them are JP, homemakers, and have completed high school. NORF (non-mobile, old, remote, female) criteria were selected following Kob (1985). NORF criteria are more suitable for eliciting dialectal data in Malaysia than NORM (non-mobile, old, remote, male) due to the expressive nature of female participants. There are four characteristics of the NORF criteria that have to be taken into consideration when selecting these participants. The first characteristic is 'non-mobile,' meaning the participant lives permanently in her hometown or any given area. The second characteristic is 'old,' which requires the participant to be in their 40's to 60's. The third characteristic is 'remote,' meaning the participant has to live far away from the city center. The last characteristic of these criteria is 'female,' which requires only female participants. Only female speakers were chosen to take part in this study. It was done to lessen the impact of specific speaker effects (Jacobi, 2009).

Adult males and females have varying voice tract lengths. Adult female voice tracts are approximately 13 cm long, but adult male vocal tract lengths might vary by up to 18 cm (Maragakis, 2008). In addition, females' vocal tracts have resonance frequencies greater than men's (Flynn, 2011), resulting in formant frequencies that are 10% to 15% higher in females than in males (Simpson, 2009; Wang & van Heuven, 2006). A questionnaire was distributed to the participants. The questions include their occupation, place of birth, the primary language spoken at home, and the length of residency in the current location. The significance was to ascertain that the

participants are native PM speakers, speak Malay as their first language at home, and have been living in Penang throughout their lives. Table 6 shows the demographic background of the PM participants.

Table 6
*Demographic background of Penang Malay participants*

| Penang Malay speakers | Age | Occupation | Place of birth | Period of residency | Level of education | Primary language |
|---|---|---|---|---|---|---|
| PM1 | 54 | Housewife | Penang | Since birth | SPM | Bahasa Malaysia |
| PM2 | 68 | Housewife | Kedah | 38 years | SPM | Bahasa Malaysia |
| PM3 | 63 | Housewife | Penang | Since birth | SPVM | Bahasa Malaysia |
| PM4 | 67 | Housewife | Penang | Since birth | SPM | Bahasa Malaysia |
| PM5 | 65 | Housewife | Penang | Since birth | Senior Cambridge | Bahasa Malaysia |

Due to the rapid urbanization that takes place on Penang Island in general, all participants were selected from the community of JP at Masjid Jamek Lebuh Acheh, George Town, Penang, because the JP in the surrounding area still converses in PM dialect daily and also to keep the geographical variable consistent. They are also actively involved in preserving the PM dialect and JP identity. The participants were all born in Penang except for Participant 2 (PM2) who born in Kedah. Besides, she was married to a Penang-born man and had been living in Penang for 38 years. Notwithstanding, further auditory and acoustic analyses reveal that PM2's realizations were similar to other participants, and her Kedahan roots did not influence her.

**Instruments**

The participants were given a word list to read without being informed of the target vowels to prevent them from being cautious of their pronunciation. The words were written using the spelling normally used by PM speakers in everyday speech. Krapp (1926) and Bowdre (1964) labeled this phenomenon as Eye Dialect, which refers to using nonstandard spelling for speech to emphasize pronunciation. The rationale behind this method was to ensure that the participants' reading of the word list would be more natural. Eight vowels were analyzed for PM, namely [a], [i], [u], [ɛ], [ɔ], [ə], [e], and [o]. Each participant was asked to repeat the word list three times to determine the consistency of their pronunciation. To

minimize the possibility of co-articulatory effects on the target vowels, all vowels that occurred after approximants /j/, /w/, /r/, or before /l/ were avoided (Deterding, 1997). Table 7 shows the word list used for PM.

Table 7
*The word list used for PM*

| Target vowel | Word | Phonetic transcription | English translation |
|---|---|---|---|
| [a] | *b**a**kaq* | [b**a**kaʔ̃] | burn |
| | *b**a**kui* | [b**a**koj] | basket |
| | *b**a**hu* | [b**a**hu] | shoulder |
| [i] | *k**i**paih* | [k**i**pajh] | fan |
| | *p**i**kiaq* | [p**i**kjaʔ̃] | think |
| | *p**i**kat* | [p**i**kat] | flirt |
| [u] | *p**u**daq* | [p**u**daʔ̃] | fade |
| | *p**u**kui* | [p**u**koj] | hit |
| | *b**u**kak* | [b**u**kaʔ] | open |
| [ɛ] | *s**e**pak* | [sɛpaʔ] | kick |
| | *b**e**sok* | [bɛsoʔ] | tomorrow |
| | *m**e**ja* | [mɛdʒa] | desk |
| [ɔ] | *sot**o**ng* | [sotɔŋ] | squid |
| | *pok**o**k* | [pokɔʔ] | tree |
| | *pot**o**ng* | [potɔŋ] | cut |
| [ə] | *b**e**saq* | [bəsaʔ̃] | big |
| | *k**e**cik* | [kəciʔ] | small |
| | *k**e**baih* | [kəbajh] | numb |
| [e] | *p**e**sta* | [p**e**sta] | festival |
| | *sat**e*** | [sat**e**] | satay |
| | *h**e**mah* | [h**e**mah] | polite |
| [o] | *kat**o**k* | [kat**o**ʔ] | knock |
| | *s**o**to* | [s**o**to] | soto (food) |
| | *m**o**hon* | [m**o**hon] | apply |

**Data Collection Procedures**

The participants were given one to two minutes to review the word list before the recording sessions. The rationale was to ensure the participants were familiar and comfortable with the words they had to pronounce. All the words were presented in a carrier frame: *ulang PERKATAAN semula* (say WORD again). The main reason was to ensure the participants read the words at a stable and normal pace. Ladefoged (2003) conceded that if 'say and again' are used in the same context, it can be assumed that the speaker is speaking at a constant rate. The recordings were set to mono and sampled at 22050 Hz, as Ladefoged (2003) recommended. The Marantz PMD661MKII handheld solid-state recorder was used to record all the tokens. The software used to analyze the vowels was Praat version 6.0.50 (Boersma & Weenink, 2019). Praat is an open-software tool used to analyze speeches in phonetics.

**Data Analysis**

The tokens collected from PM participants were 360 tokens (24 words x 3 recordings x 5 participants). The tokens were then imported to Praat version 6.0.50 (Boersma & Weenink, 2019) to be analyzed. The software was used to listened to the sound files and viewed the spectrograms and waveforms. The Formant Frequency Model was used to analyze the vowels as this model is commonly used in the instrumental analysis of vowels (Deterding, 1997; Hawkins & Midgley, 2005; Watt & Tillotson, 2001).

Based on the Formant Frequency Model, the midpoint of each vowel was measured to get the first (F1) and second (F2) formant values. The midpoint of a vowel is considered the steadiest state of the vowel and the least influenced sound (Adank et al., 2004; Ladefoged, 2003; Pillai & Yusuf, 2012; Watt & Tillotson, 2001). After every vowel was measured, the values of the formants in Hertz were converted into a Bark scale because "it is thought to be a good approximation of the actual frequency analysis performed by the ear" (Pillai et al., 2012, p.115), and it would help in the plotting of vowels on the scatter plot. The formula used to convert Hertz into a Bark scale was reproduced from Zwicker and Terhardt (1980):

$$Z = 13 \arctan (0.00076F) + 3.5 \arctan (F/7500)^2$$

This study also conducted an independent samples *t*-test to examine the significance between /ɛ/ and /e/ and /ɔ/ and /o/. The primary goal of adopting this statistical analysis was to determine the significance of the vowel quality of these vowels. This study used GraphPad Prism version 8.0.0 for Windows to analyze the independent samples *t*-test.

## RESULTS AND DISCUSSION

The averages of F1 (Hz) and F2 (Hz) values for all eight vowels of PM, standard deviations of F1 and F2 values, and averages of F1 (Bark) and F2 (Bark) values are presented in Table 8.

Figure 2 shows the monophthongs of PM on a vowel quadrilateral. Based on the findings, the positioning of six out of the eight vowels on a vowel quadrilateral follows Omar's (1993) and Maris' (1980) initial impressionistic study of vowels. The vowels [ɛ] and [e] were found to be conflated in vowel quality. Based on the independent samples *t*-test, there were no significant differences between the F1 and

Table 8
*Averages of F1 and F2 values for Penang Malay monophthongs*

| Tokens | Ave F1 (Hz) | SD F1 (Hz) | Ave F2 (Hz) | SD F2 (Hz) | Ave F1 (Bark) | SD F1 (Bark) | Ave F2 (Bark) | SD F2 (Bark) |
|---|---|---|---|---|---|---|---|---|
| [a] | 761.4 | 97.8 | 1446.1 | 170.7 | 6.8 | 0.7 | 10.9 | 0.8 |
| [i] | 336.6 | 45.8 | 2477.4 | 224.2 | 3.3 | 0.4 | 14.4 | 0.6 |
| [u] | 392.4 | 45.8 | 912.8 | 182.8 | 3.8 | 0.4 | 7.9 | 1.1 |
| [ɛ] | 445.7 | 64.8 | 2368.3 | 315.2 | 4.2 | 0.6 | 14.1 | 0.9 |
| [ɔ] | 620.4 | 49.5 | 1063.2 | 95.0 | 5.7 | 0.4 | 8.9 | 0.6 |
| [ə] | 475.4 | 65.5 | 1680.1 | 311.7 | 4.5 | 0.6 | 11.8 | 1.3 |
| [e] | 467.1 | 64.6 | 2298.8 | 362.8 | 4.4 | 0.6 | 13.9 | 1.1 |
| [o] | 550.9 | 67.2 | 993.9 | 164.6 | 5.2 | 0.6 | 8.4 | 1.0 |

*Note.* Ave = Average, SD = Standard deviation

F2 average values of the said vowels (F1: $t(90) = 1.57$, $p = 0.120$; F2: $t(90) = 0.97$, $p = 0.335$), indicating that these vowels were produced similarly. This study's vowel [ɛ] is in a close-mid front position. On the other hand, the vowel [e] in this study is in an open-mid front position. It should also be noted that this study's vowels [o] and [ɔ] moved further toward the central position.

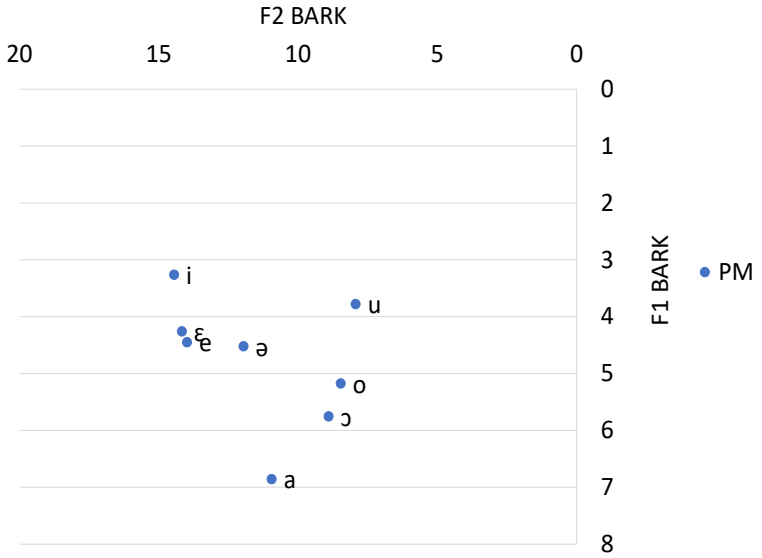


*Figure 2*. Vowel quadrilateral for PM monophthongs

**Penang Malay [a]**

Figure 3 shows the distribution of [a] by the PM participants. Here, there is an overlapping distribution of [a] among the PM participants except for PM3, as her vowel production is distant in the vowel space compared to the other participants. PM3's realization is further fronted and lower than other PM participants' near-front, open position. In addition, the distribution of [a] in this study is scattered.

**Penang Malay [i]**

Figure 4 shows the distribution of [i] by the PM participants. It shows a high overlapping distribution among the PM participants except for a minor inconsistency and deviation made by PM3 in one of her realizations. The distribution of [i] in the vowel space is distributed in a close, front position (Figure 4).

**Penang Malay [u]**

Figure 5 shows the distribution of [u] by the PM participants. Here, there is a considerable overlapping distribution of [u] in the vowel space despite the few inconsistencies and deviations made by the participants. The distribution of [u] in Figure 5 moves towards the central position instead

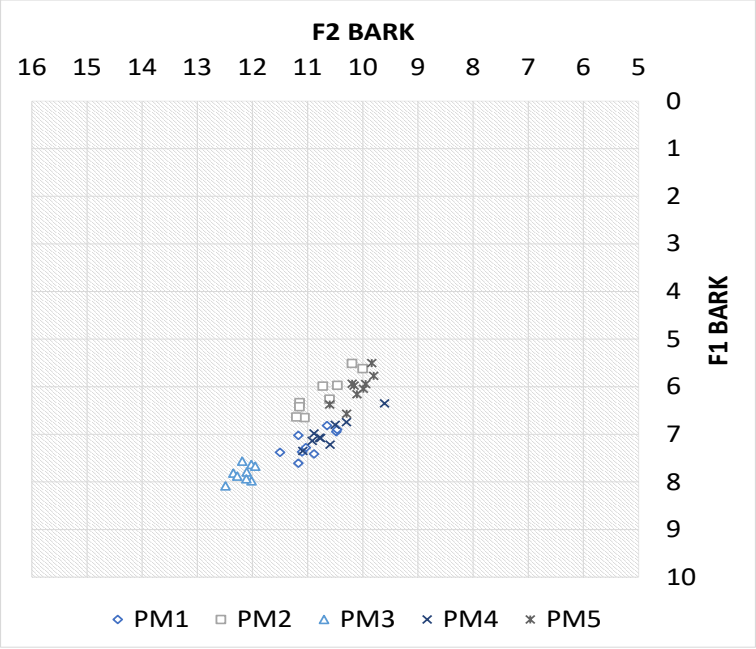


*Figure 3*. Scatter plot for [a] of PM monophthong

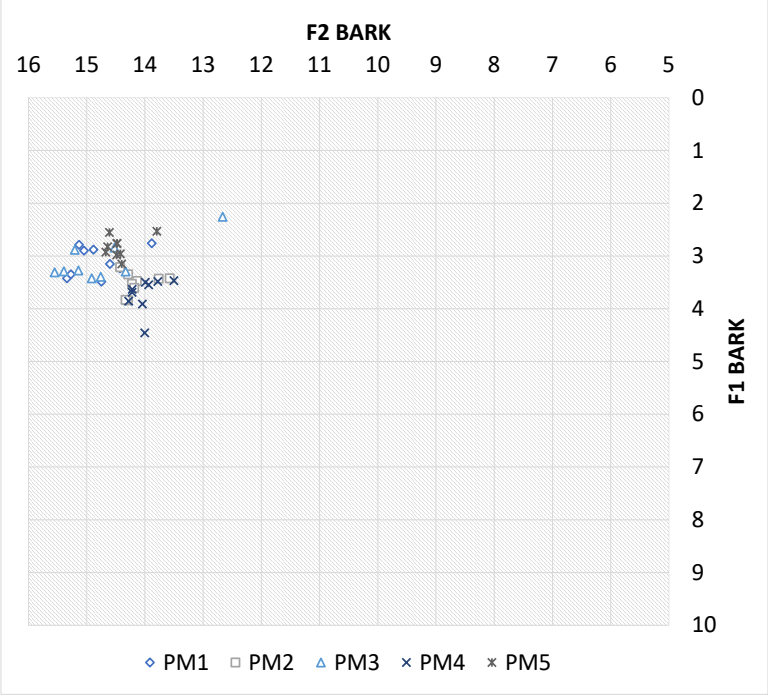


*Figure 4*. Scatter plot for [i] of PM monophthong

of in a close, back position. According to Figure 5, several inconsistencies and deviations are made by PM2, PM3, and PM5; however, the rest of the realizations have still closely scattered one another.

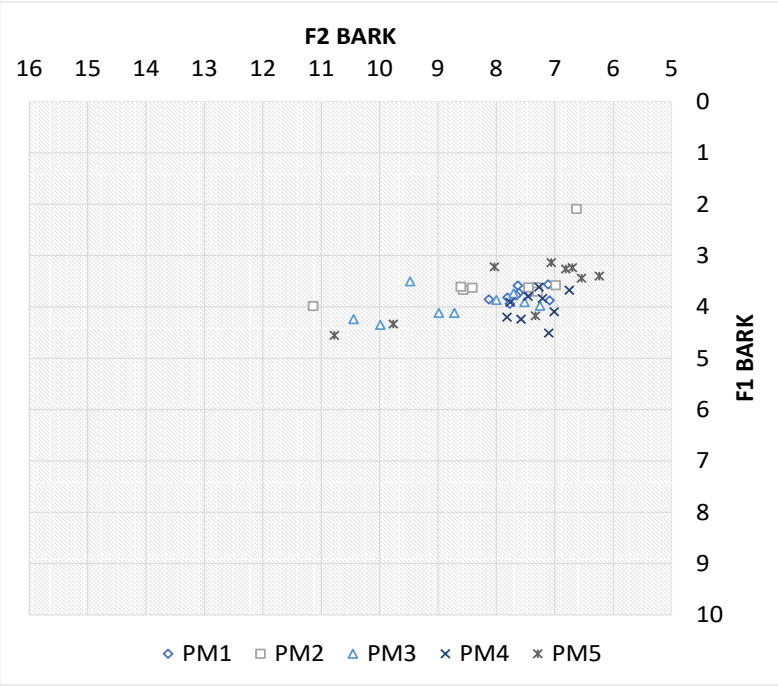


*Figure 5*. Scatter plot for [u] of PM monophthong

**Penang Malay [ɛ] and Penang Malay [e]**

Figure 6 shows the distribution of [ɛ] by the PM participants. There is a high overlapping distribution of [ɛ] in the vowel space among the PM participants, except for several inconsistencies and deviations made by PM1 and PM4. Based on the average values of F1 (445.7 Hz) and F2 (2368.3 Hz) for all participants, the vowel [ɛ] in this study moves towards the mid-front position. PM1's vowel production moves towards the mid-open front position, while PM4's production moves toward the open mid, front position. However, PM1's and PM4's realizations overlapped considerably with the other PM participants. Based on the convention of vowels from an impressionistic approach as proposed by Omar (1993), Maris (1980), and Teoh (1994), the vowels [ɛ] and [e] in this study were found to be inverted in terms of their positions on the vowel chart and conflated in vowel quality with each other.

Figure 7, however, shows the PM participants' distribution of [e]. Based on the figure, there is considerable overlapping in the distribution of [e] in the vowel space among the PM participants, except for a minor inconsistency from PM1 in one of her realizations. In contrast, the rest of her

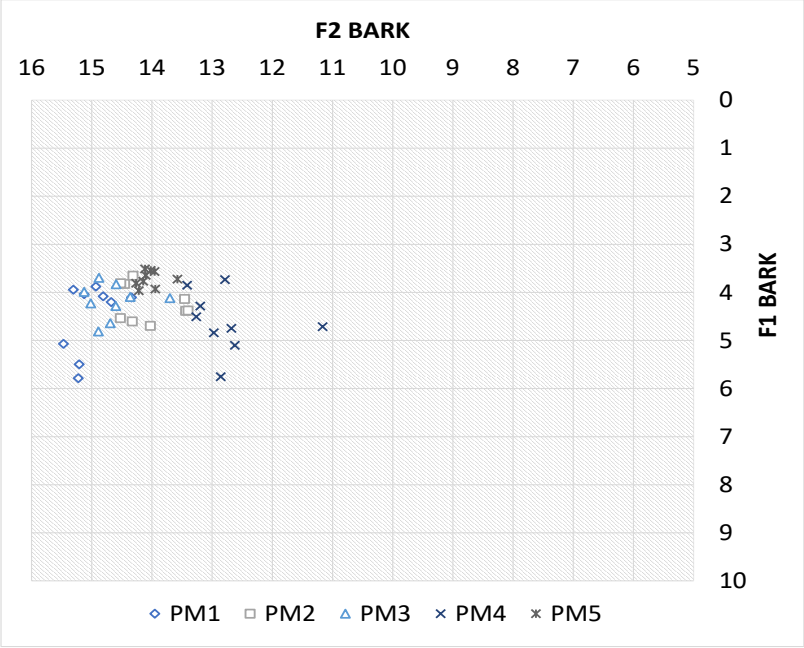


*Figure 6*. Scatter plot for [ɛ] of PM monophthong

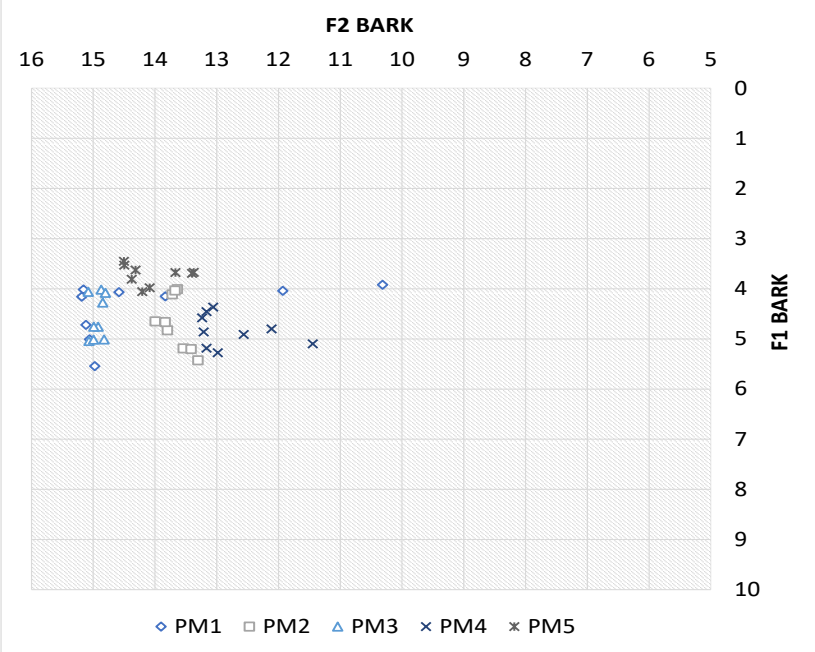


*Figure 7*. Scatter plot for [e] of PM monophthong

realizations were consistent with the other speakers. The production of [e] in this study is in an open-mid, front position.

Figure 8 shows the distribution of the vowels [e] and [ɛ] on a scatter plot. Based on the findings of this study, vowels [ɛ] and [e] were found to be conflated in quality and inverted in terms of their positions on the vowel chart. Based on the independent samples *t*-test, there were no significant differences between the F1 and F2 average values of the said vowels (F1: $t(90) = 1.57$, $p = 0.120$; F2: $t(90) = 0.97$, $p = 0.335$), indicating that these vowels were produced similarly. This phenomenon is not in agreement with the initial proposition of vowels from an impressionistic approach by Omar (1993), Maris (1980), and Teoh (1994). However, based on the findings from this study, this conflation can be best represented by [e] because this vowel exists in PM and SM.

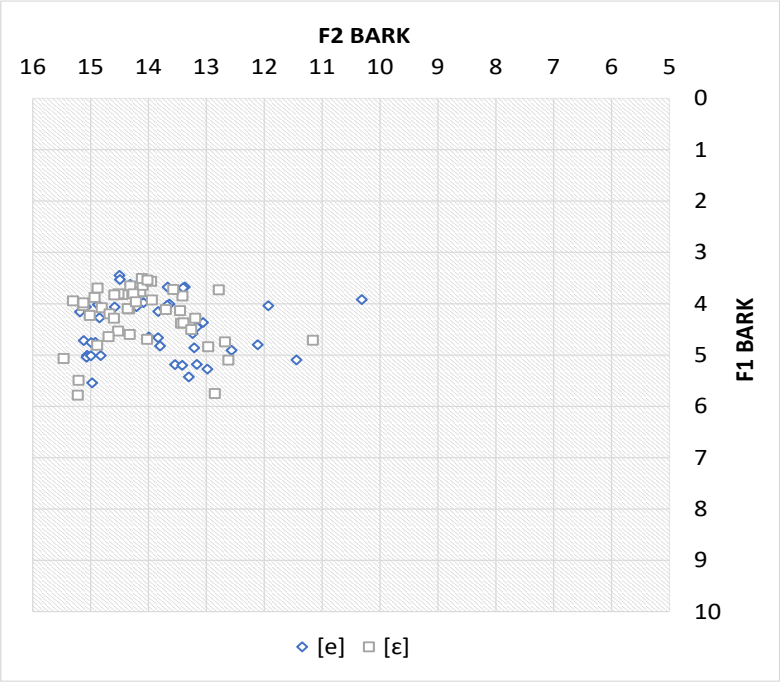


*Figure 8*. Scatter plot for [e] and [ɛ] of PM monophthongs

**Penang Malay [ɔ]**

Figure 9 shows the distribution of [ɔ] by the PM participants. Here, there is a high overlapping distribution of [ɔ] in the vowel space by the PM participants despite some inconsistencies from PM5. PM5's realizations moved towards the mid-back position as opposed to other participants. Based on the average values of F1 (620.4 Hz) and F2 (1063.2 Hz) for all participants, the vowel [ɔ] in this study moved towards a near-open, central position.

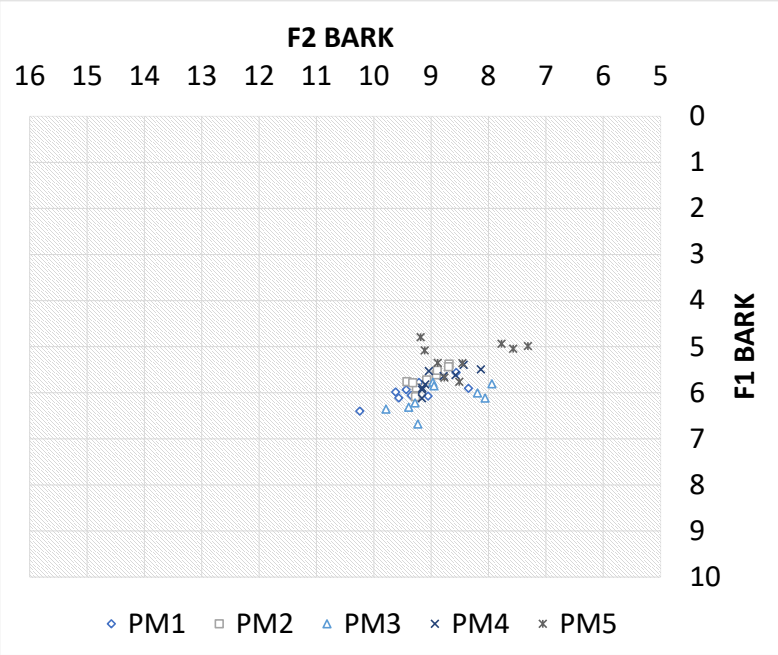


*Figure 9*. Scatter plot for [ɔ] of PM monophthong

**Penang Malay [ə]**

Figure 10 shows the distribution of [ə] by the PM participants. The results for [ə] in this study are inconclusive as all participants had produced different realizations, which caused the plotting to be scattered everywhere. This phenomenon is supported by Bates (1995), who concurs that the [ə] articulatory is "inherently unspecified for tongue position" (pp. 266-267), while Teoh (1994) assumes that the schwa lacks any distinctive height and backness specification, and thus denotes the schwa as an empty vowel.

**Penang Malay [o]**

Figure 11 shows the distribution of [o] by the PM participants. There is a noticeably high overlapping distribution of [o] among the PM participants despite a minor inconsistency and deviation from one of PM4's realizations. Based on Figure 11, this study's vowel [o] moved towards an open-mid, central position.

Based on the acoustic analysis of PM monophthongs, it was found that only seven of the eight vowels, as suggested by Omar (1993), were present in the study. The PM participants did not distinguish between the production of [ɛ] and [e] and conflated the two vowels. It is supported by the findings of Ramli et al. (2020), who found [ɛ] to be more of a front vowel instead of a central vowel. The independent samples *t*-test of the two vowels also confirmed that their statistical difference was insignificant. In addition, based on the findings from this study, this conflation can be best represented by [e] because this vowel exists in PM

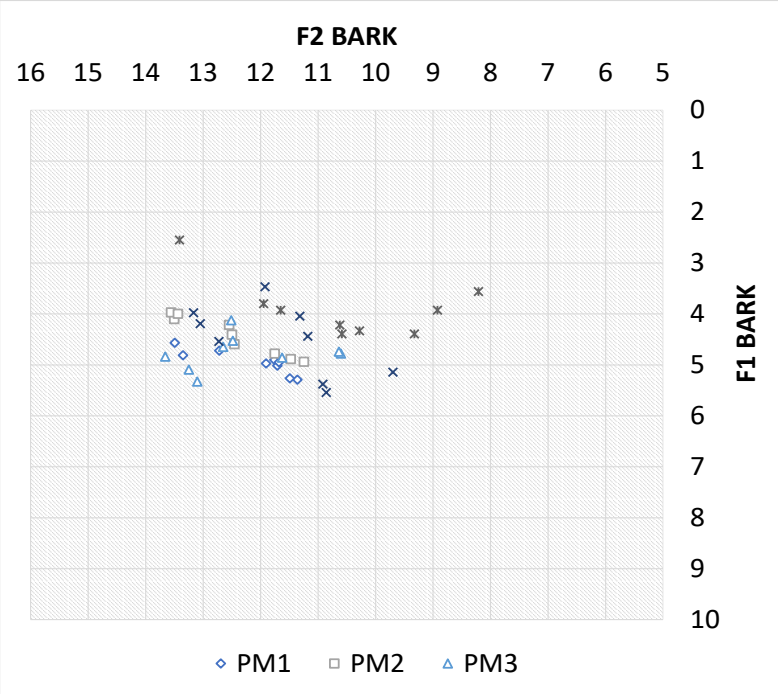


*Figure 10*. Scatter plot for [ə] of PM monophthong

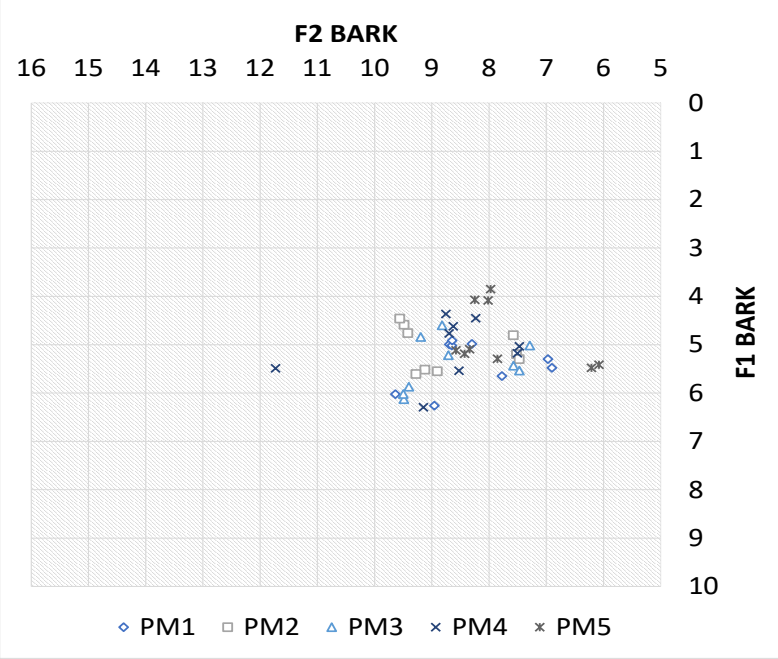


*Figure 11*. Scatter plot for [o] of PM monophthong

and SM. The vowels [ɛ] and [e] in this study were produced differently as well as compared to the ones in Azli's (2017). The vowel [ɛ] in this study is in a close-mid front position, whereas in Azli's (2017) study, it is in an open-mid front position.

On the other hand, the vowel [e] in this study is in an open-mid front position, whereas in Azli (2017), it is in a close-mid front position. It should also be noted that the vowels [o] and [ɔ] in this study moved further towards the central position, whereas in Azli (2017), the vowels [o] and [ɔ] remained as back vowels. The distribution of [a] in Azli moved towards a half-close, near-front position. In addition, the distribution of [a] in this study was closely scattered as opposed to Azli's (2017) distribution of [a], which was more scattered. The distribution of [i] in this study was distributed in a close, front position. The findings of [i] in this study were following the findings of Yusuf (2013) and Azli (2017). The schwa [ə] results in this study were inconclusive as all participants had produced different realizations, which caused the plotting to be scattered everywhere. The inconsistent results for this vowel were similar to what Azli (2017) had found in her study, in which the elicitation tokens were greatly scattered on the scatter plot. This phenomenon is supported by Bates (1995), who concurs that schwa [ə], articulatory, is "inherently unspecified for tongue position" (pp. 266-267), while Teoh (1994) assumes that schwa lacks any distinctive height and backness specification, and thus denotes schwa as the empty vowel.

## CONCLUSION

In conclusion, the PM speakers did not differentiate between the vowels [ɛ] and [e]. The two vowels were conflated as one vowel. In terms of the distribution of the vowels, the results of this study show similarities with the distribution of vowels in impressionistic studies of past researchers.

It should be noted that the results of this study cannot be generalized to represent the monophthongs of PM, as this study did not include data from male speakers or speakers from other age groups. Additionally, to obtain a more comprehensive understanding of PM, future researchers should consider different age groups, genders, and ethnic populations. The findings of this study not only challenge and complement the initial impressionistic approach in the study of acoustic phonetics of Malay dialects but also contribute to the preservation and promotion of the PM dialect.

This study has implications for both research and practice. Researchers should use a different method to elicit participant data, such as using a wider range of words or conducting interviews. Future researchers may also want to focus on the production of [ɛ] and [e] in PM to determine if the two vowels are now conflated as one vowel. For practitioners, the results highlight the importance of understanding the nuances of PM when communicating with native speakers. It is particularly relevant for language education, speech therapy, and language technology professionals. Overall, this study contributes to the growing knowledge of PM and is a foundation for further research and practical applications.

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