2.2) High - rising tone (occurs with checked syllables) [45]

The pitch pattern of this tone starts at 153.0 Hz and glides up to about 169.5 Hz (see figures 20 and 26).

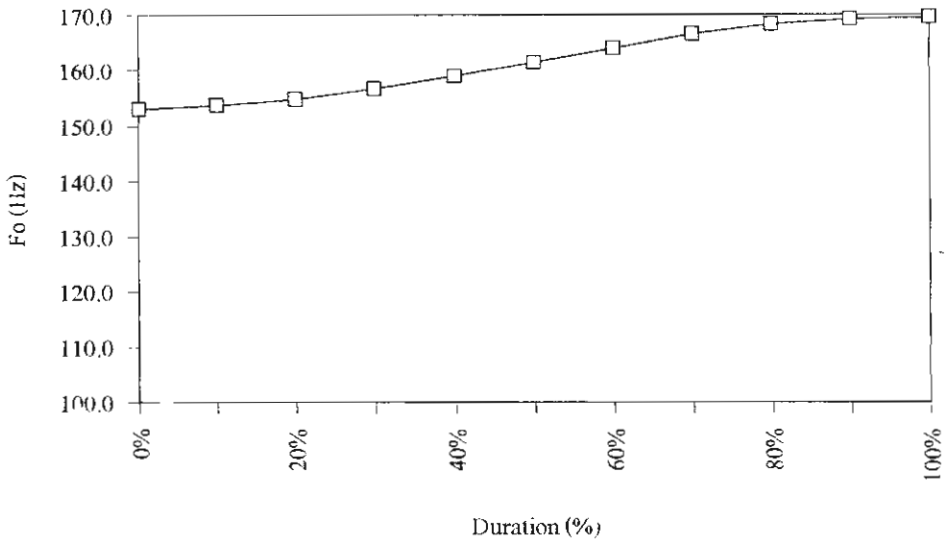


Figure 20 : ***Tone 2 on checked syllables in connected speech of Chiangrai's Northern Thai dialect pronounced by native speakers***

Ex.	[lek^{45}]	'iron'
	[tat^{45}]	'to cut'
	[dip^{45}]	'raw'
	[bat^{45}]	'card'

3.) Tone 3 : Low - falling tone [21]

The pitch pattern of this tone starts at 127.4 Hz on smooth syllables and 127.2 Hz on checked syllables and glides down to about 114.2 Hz on both smooth and checked syllables (see figures 21 and 26).

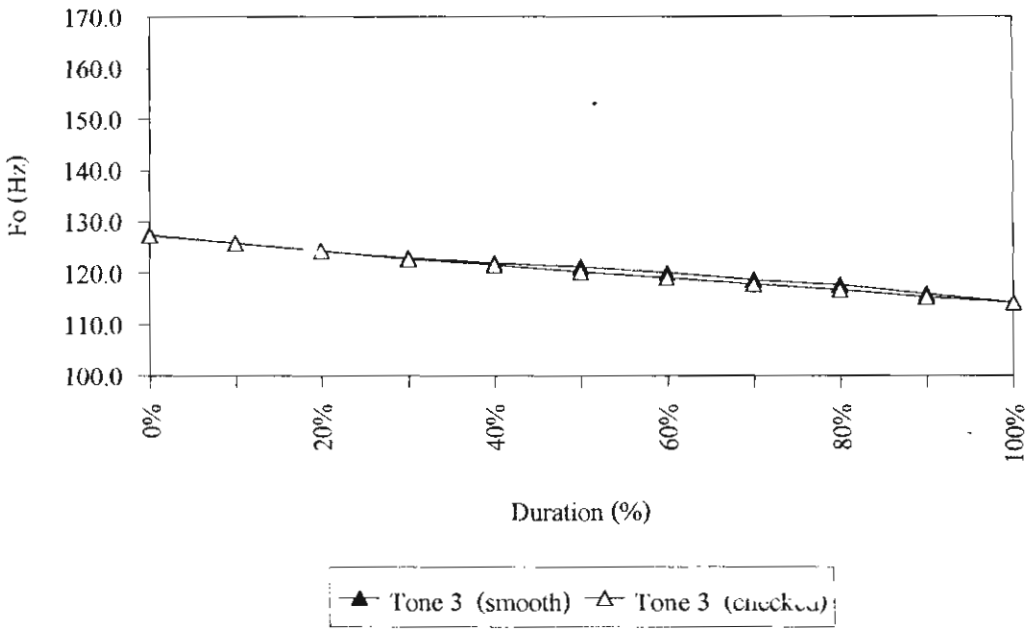


Figure 21 : ***Tone 3 on smooth and checked syllables in connected speech of Chiangrai's Northern Thai dialect pronounced by native speakers***

Ex.	[$k^ha:w^{21}$]	'news'
	[kaw^{21}]	'ancient, old'
	[den^{21}]	'prominent'
	[$t^hu:k^{21}$]	'cheap'
	[$pæ:t^{21}$]	'eight'
	[$bɔ:k^{21}$]	'to tell'

4.) Tone 4 : Mid - falling tone [31]

The pitch pattern of this tone starts at 142.9 Hz on smooth syllables and 141.4 Hz on checked syllables and falls quickly to about 105.3 Hz on smooth syllables and 103.4 Hz on checked syllables (see figures 22 and 26).

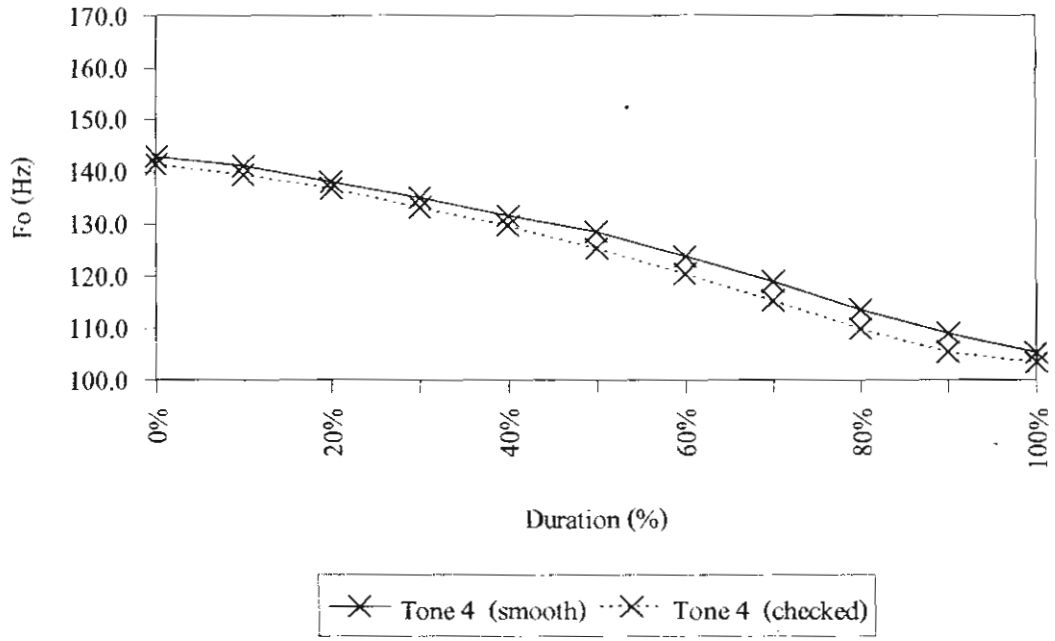


Figure 22 : ***Tone 4 on smooth and checked syllables in connected speech of Chiangrai's Northern Thai dialect pronounced by native speakers***

Ex.	[cuəy^{31}]	'to help'
	[t^{h}iəw^{31}]	'to travel'
	[cæ:^{31}]	'to steep'
	[t^{h}aw^{31}]	'to be equal to'

5.) Tone 5 has 2 allotones which are in complementary distribution as follows:

5.1) High-mid-falling tone (occurs with smooth syllables) [43]

The pitch pattern of this tone starts at 151.5 Hz and glides down to about 133.1 Hz (see figures 23 and 26).

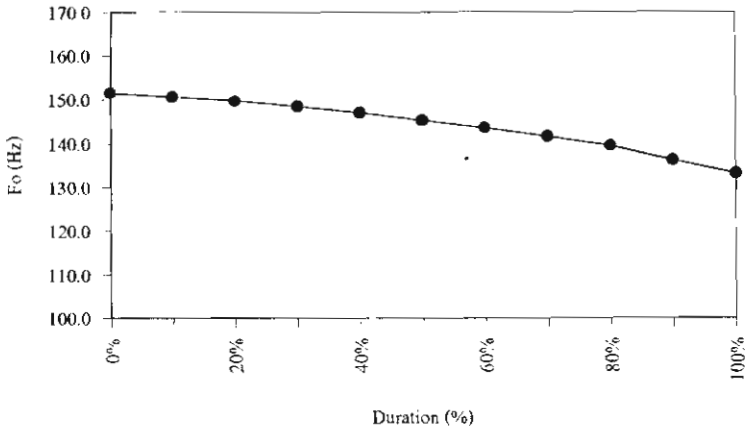


Figure 23 : ***Tone 5 on smooth syllables in connected speech of Chiangrai's Northern Thai dialect pronounced by native speakers***

Ex.	[hæːŋ^{43}]	'dry'
	[caːŋ^{43}]	'to hire'
	[baːn^{43}]	'house'
	[daːn^{43}]	'side'

5.2) High-high-falling tone (occurs with checked syllables) [54]

The pitch pattern of this tone starts at 169.6 Hz and glides down to about 151.7 Hz (see figures 24 and 26).

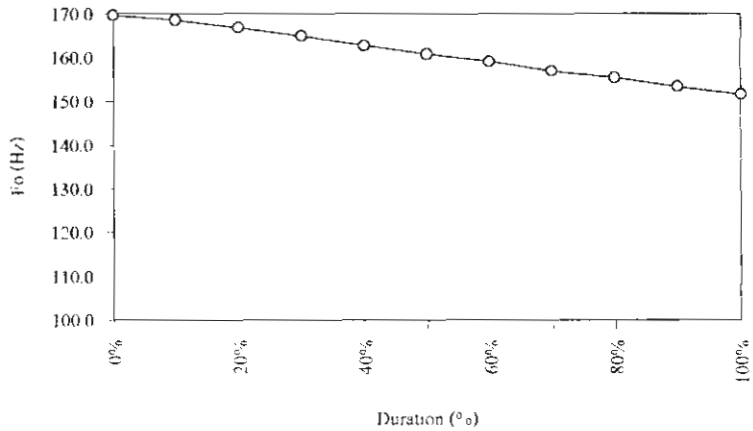


Figure 24 : ***Tone 5 on checked syllables in connected speech of Chiangrai's Northern Thai dialect pronounced by native speakers***

Ex.	[mat^{54}]	'to tie'
	[rap^{54}]	'to receive'
	[met^{54}]	'seed'
	[p^{h}ap^{54}]	'to fold'
	[lot^{54}]	'to reduce'

6.) Tone 6 : High - low falling tone [52]

The pitch pattern of this tone starts at 166.4 Hz and falls quickly to about 117.7 Hz (see figures 25 and 26).

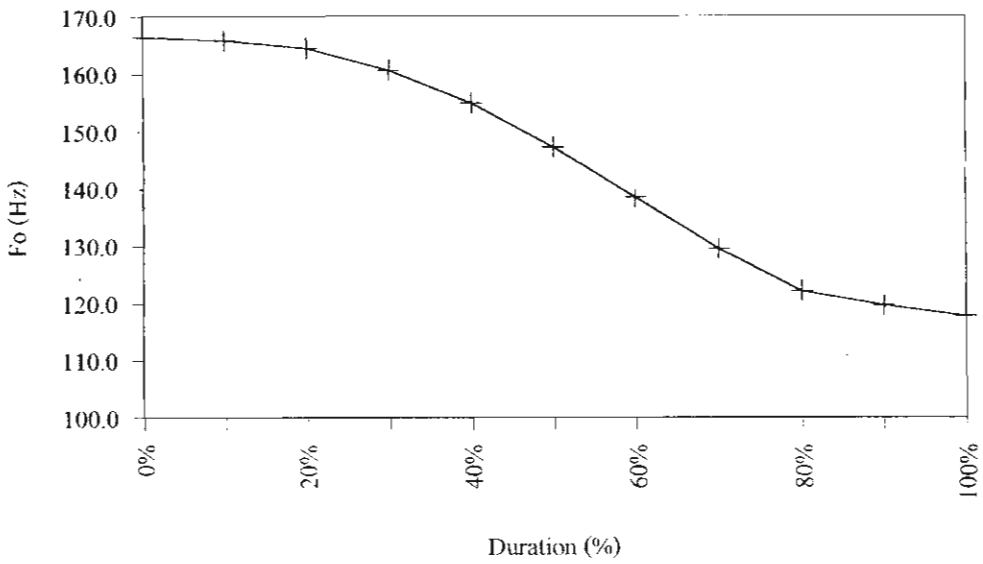


Figure 25 : ***Tone 6 in connected speech of Chiangrai's Northern Thai dialect pronounced by native speakers***

Ex.	[si:^{52}]	'to buy'
	[t^{h}a:y^{52}]	'rear'
	[fa:^{52}]	'sky'
	[ma:y^{52}]	'wood'
	[ɪɔ:y^{52}]	'hundred'

All the tones on smooth and checked syllables are put into the same diagram as follows:

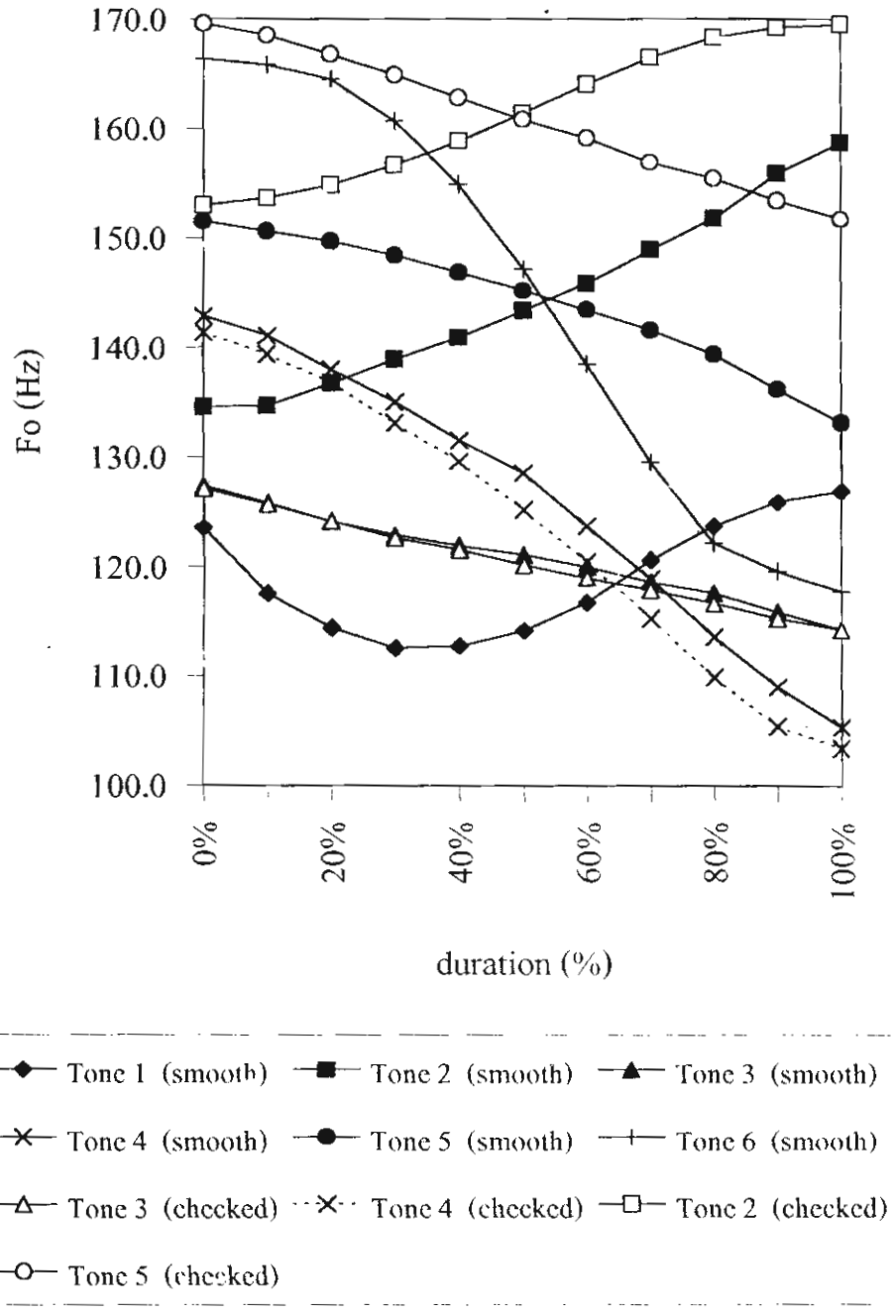


Figure 26 : ***Tone features in connected speech of Chiangrai's Northern Thai dialect pronounced by native speakers***

4.1.5 Comparison of tonal systems and tone features between citation form and connected speech

1.) Tonal system

Table 15 : ***Comparison of tonal systems between citation form and connected speech of Chiangrai's Northern Thai dialect pronounced by native speakers***

A	*B*	*C*	*DL*	*DS*
Tone 1	*Tone 3*	*Tone 5*	*Tone 3*	*Tone 2*
Tone 2	*Tone 4*	*Tone 6*	*Tone 4*	*Tone 5*

Citation form

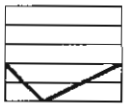
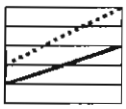
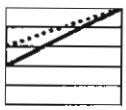
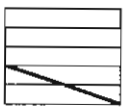
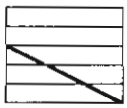
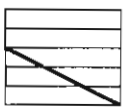
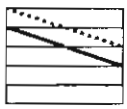
A	*B*	*C*	*DL*	*DS*
Tone 1	*Tone 3*	*Tone 5*	*Tone 3*	*Tone 2*
Tone 2	*Tone 4*	*Tone 6*	*Tone 4*	*Tone 5*

Connected speech

Table 15 indicates that the tonal systems in both citation form and connected speech are not different. That is, tone ***A*** reflects the glottalization split and the tones in other columns, ***B***, ***C***, ***DL***, and ***DS***, always reflect the voiced-voiceless split.

2.) Tone features

Table 16 : ***Comparison of tone features between citation form and connected speech of Chiangrai's Northern Thai dialect pronounced by native speakers***

Form of Speech / Tone	**Citation form**	**Connected speech**
Tone 1	Low - falling - rising tone [212] 105.3 Hz - 98.3 Hz - 107.5 Hz 	Low - falling - rising tone [212] 123.6 Hz - 112.6 Hz - 126.9 Hz 
Tone 2	Low - rising tone [23] (smooth) 116.5 Hz - 126.6 Hz Mid - rising tone [35] (checked) 127.2 Hz - 146.4 Hz 	Mid - rising tone [35] (smooth) 134.5 Hz - 158.7 Hz High - rising tone [45] (checked) 153.0 Hz - 169.5 Hz 
Tone 3	Low - level tone [22] 120.7 Hz - 110.0 Hz (smooth) 120.3 Hz - 112.4 Hz (checked) 	Low - falling tone [21] 127.4 Hz - 114.2 Hz (smooth) 127.2 Hz - 114.2 Hz (checked) 
Tone 4	Mid - falling tone [31] 124.1 Hz - 95.1 Hz (smooth) 125.4 Hz - 103.1 Hz (checked) 	Mid - falling tone [31] 142.9 Hz - 105.3 Hz (smooth) 141.4 Hz - 103.4 Hz (checked) 
Tone 5	High - mid - falling tone [43] 138.1 Hz -122.6 Hz (smooth) High - high - falling tone [54] 152.9 Hz - 140.2 Hz (checked) 	High - mid - falling tone [43] 151.5 Hz - 133.1 Hz (smooth) High - high - falling tone [54] 169.6 Hz - 151.7 Hz (checked) 

(Table 16)

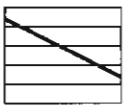
Form of Speech / Tone	**Citation form**	**Connected speech**
Tone 6	High - low - falling tone [52] 154.0 Hz - 106.7 Hz 	High - low - falling tone [52] 166.4 Hz - 117.7 Hz 

Table 16 indicates that the tone features in citation form are different from connected speech in tones 2 and 3 as follows:

(i) Tone 2, mid-rising tone in citation form occurs with checked syllables whereas mid-rising tone in connected speech occurs with smooth syllables.

(ii) Tone 3, the feature of this tone in citation form is low level tone whereas the tone feature in connected speech is low falling tone.

Concerning the fundamental frequency, it is interesting to note that the fundamental frequencies of each tone in citation form are lower than in connected speech.

4.2 Tonal System and Tone Features of Lahu

4.2.1 Tonal system

I have analyzed the tonal system in citation form of the Lahu language pronounced by an informant who is native Lahu speaker. The results were found that the Lahu language has 7 tones as follows:

Tone 1 low - level tone
Tone 2 low - level - glottalized tone
Tone 3 mid - falling tone
Tone 4 high - falling tone
Tone 5 high - falling - glottalized tone
Tone 6 high - level tone
Tone 7 high - level - glottalized tone

4.2.2 Tone features

1.) Tone 1 : Low - level tone [22]

The pitch pattern of this tone starts at 122.1 Hz, glides down a little to about 119.7 Hz, and rises to about 123.1 Hz, then falls quickly to about 117.1 Hz (see figures 27 and 34).

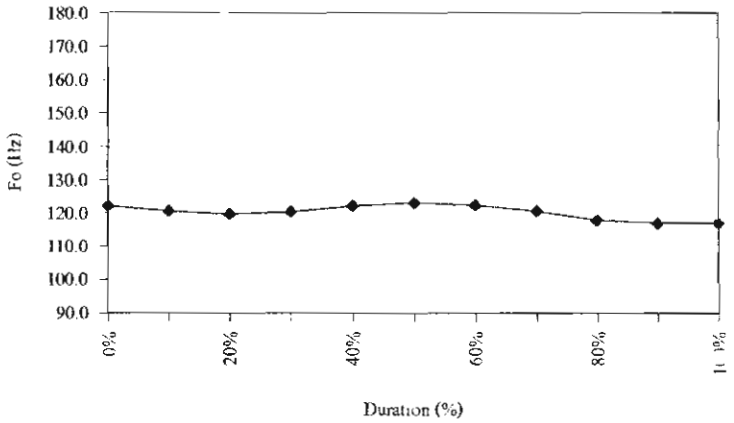


Figure 27 : ***Tone 1 of Lahu pronounced by native speaker***

Ex.	[$p^h ɔ^{22}$]	'to open'
	[$p^h ɛ^{22}$]	'to tie'

2.) Tone 2 : Low - level - glottalized tone [22?]

The pitch pattern of this tone starts at 122.3 Hz and glides down a little to about 116.0 Hz. The glottal stop is heard at the end of the tone (see figures 28 and 34).

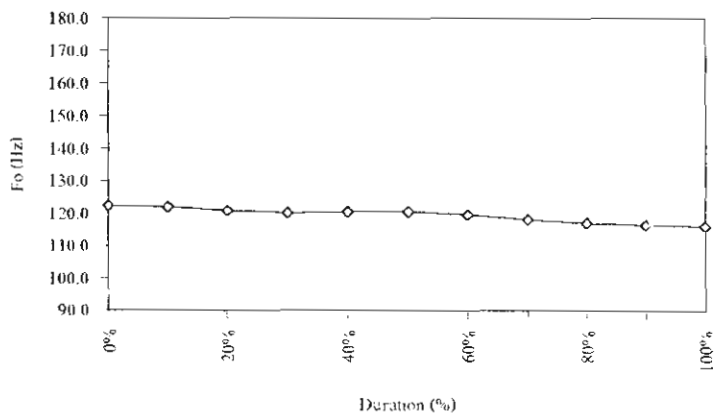


Figure 28 : ***Tone 2 of Lahu pronounced by native speaker***

Ex. [$p^hu^{22?}$ tsɯ^{22}] 'papaya'
[tɛ$^{22?}$] 'to fart'

3.) Tone 3 : Mid - falling tone [31]

The pitch pattern of this tone starts at 134.7 Hz and falls quickly to about 99.3 Hz (see figures 29 and 34).

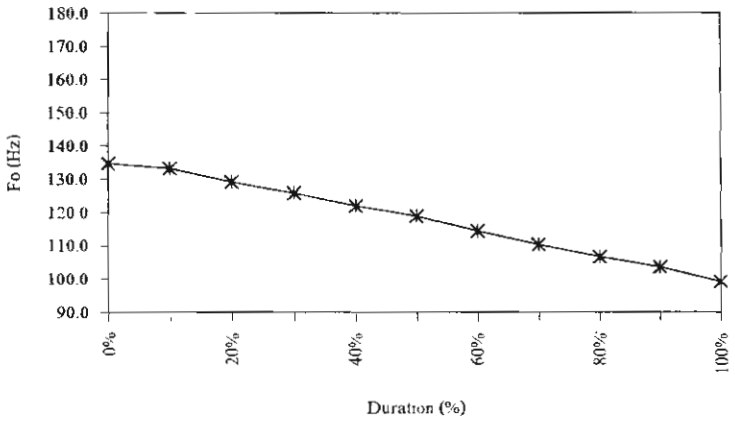


Figure 29 : ***Tone 3 of Lahu pronounced by native speaker***

Ex. [$p^hɯ^{31}$] 'dog'
[bi^{31}] 'full'

4.) Tone 4 : High - falling tone [42]

The pitch pattern of this tone starts at 145.7 Hz and falls quickly to about 122.9 Hz (see figures 30 and 34).

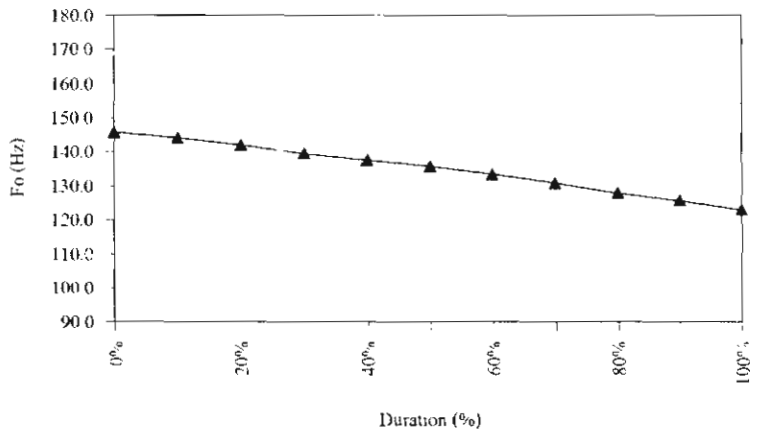


Figure 30 : ***Tone 4 of Lahu pronounced by native speaker***

Ex. [pɯ^{42} tu^{42}] 'comb'
[mɯ^{42}] 'song'

5.) Tone 5 : High - falling - glottalized tone [43ʔ]

The pitch pattern of this tone starts at 147.3 Hz and glides down to about 130.3 Hz. The glottal stop is heard at the end of the tone (see figures 31 and 34).

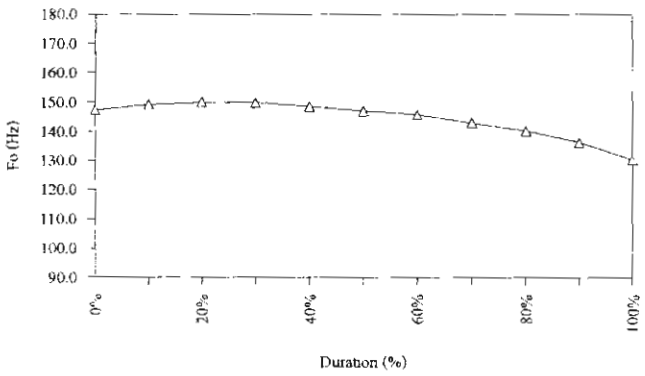


Figure 31 : *Tone 5 of Lahu pronounced by native speaker*

Ex. [tu^{43ʔ}] 'to bail'
[ŋa^{43ʔ}] 'fish'

6.) Tone 6 : High - level tone [55]

The pitch pattern of this tone starts at 165.3 Hz, rises to about 167.9 Hz, and glides down a little to about 162.7 Hz (see figures 32 and 34).

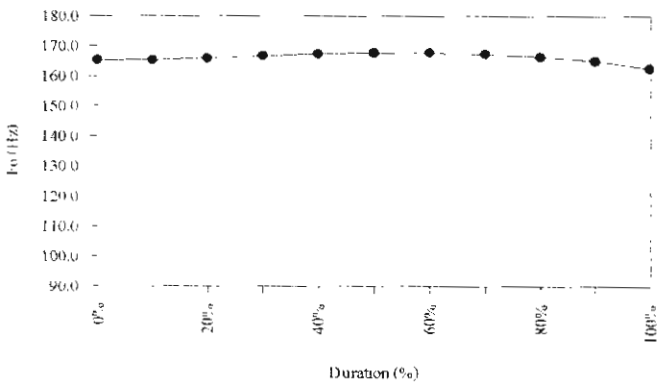


Figure 32 : *Tone 6 of Lahu pronounced by native speaker*

Ex. [pɯ^{55}] 'mosquito, a fly'
[pe^{55}] 'waste'

7.) Tone 7 : High - level glottalized tone [55ʔ]

The pitch pattern of this tone starts at 159.3 Hz and glides up to about 163.8 Hz, then falls quickly to about 159.2 Hz. The glottal stop is heard at the end of the tone (see figures 33 and 34).

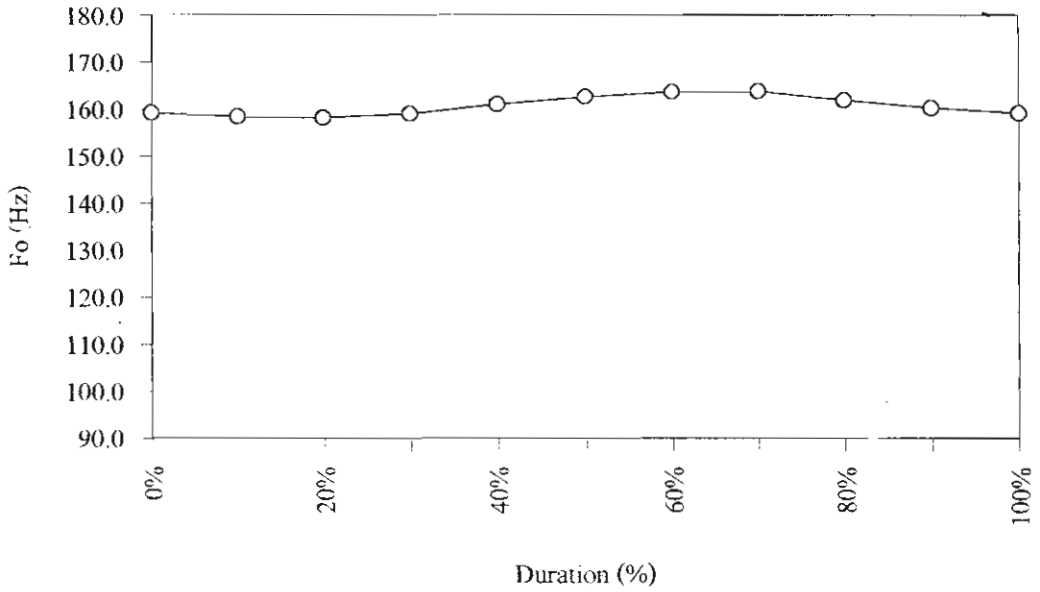


Figure 33 : ***Tone 7 of Lahu pronounced by native speaker***

Ex. [ŋɛ^{55ʔ}] 'bird'
[pɔ^{55ʔ}] 'to jump'

Each tone of Lahu is put into the same diagram as follows:

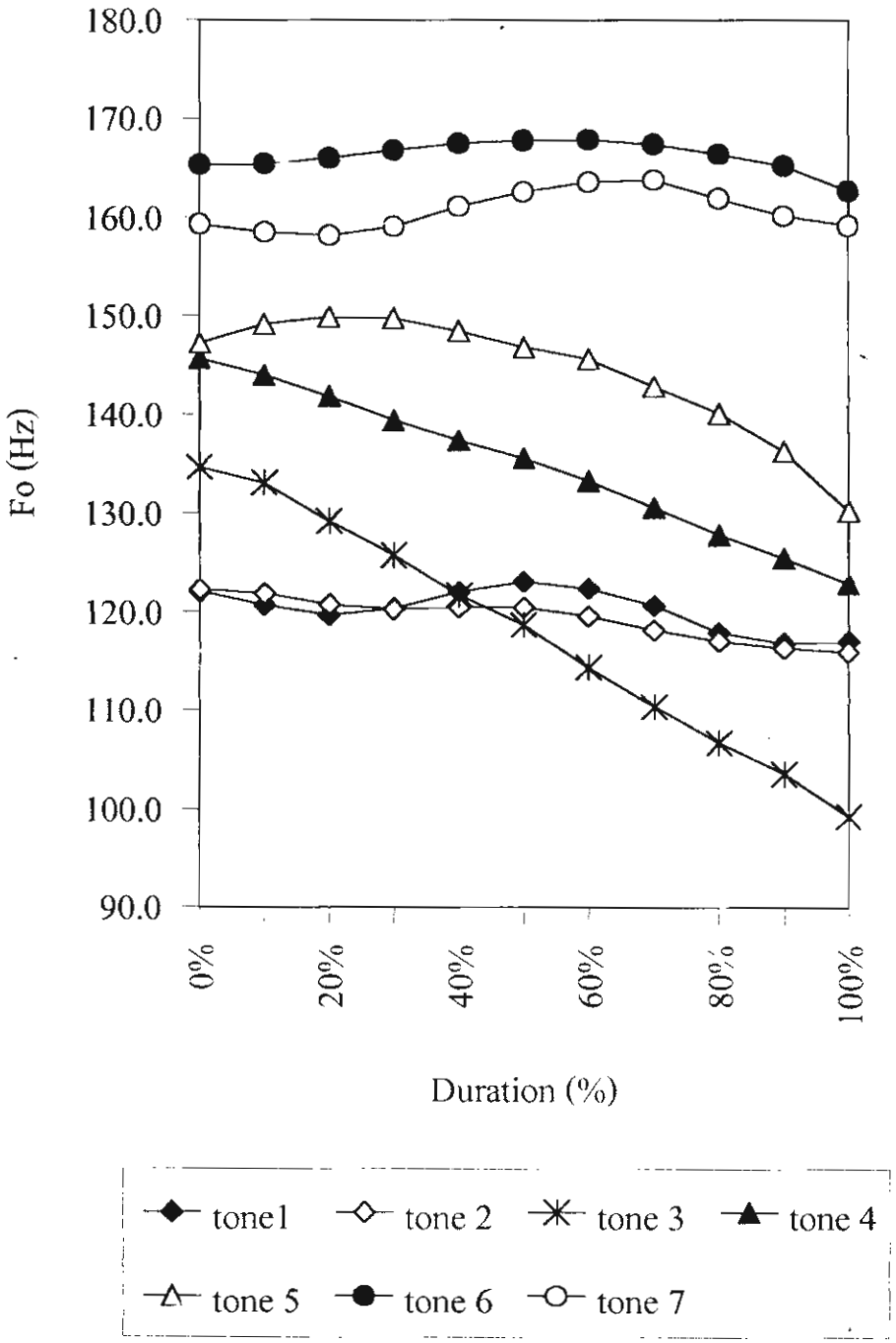


Figure 34 : ***Tone features of Lahu pronounced by native speaker***

4.3 Tonal system and tone features of Akha

4.3.1 Tonal system

There are 5 tones in Akha as follows :

Tone 1 low - falling tone
Tone 2 low - falling - glottalized tone
Tone 3 mid - level tone
Tone 4 mid - rising tone
Tone 5 high - level tone

4.3.2 Tone features

1.) Tone 1 : Low - falling tone [21]

The pitch pattern of this tone starts at 114.1 Hz and glides down to about 99.3 Hz (see figures 35 and 40).

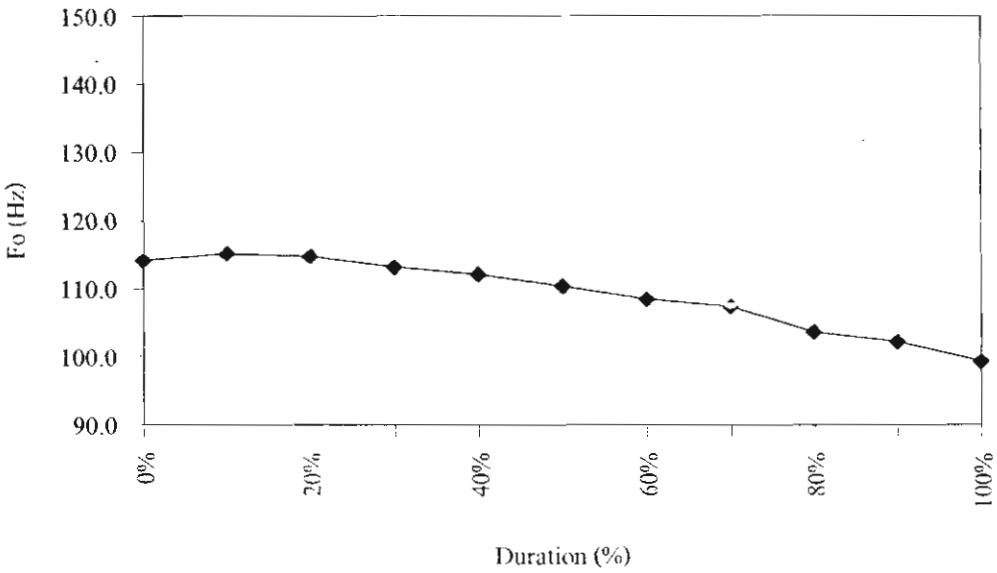


Figure 35 : ***Tone 1 of Akha pronounced by native speaker***

Ex. [kɔ^{21} dʒɔ^{21}] 'mountain'
[mɛ^{21} ʔə^{33}] 'to teach'

2.) Tone 2 : Low - falling - glottalized tone [21ʔ]

The pitch pattern of this tone starts at 115.9 and glides down to about 109.1 Hz. The glottal stop is heard at the end of the tone (see figures 36 and 40).

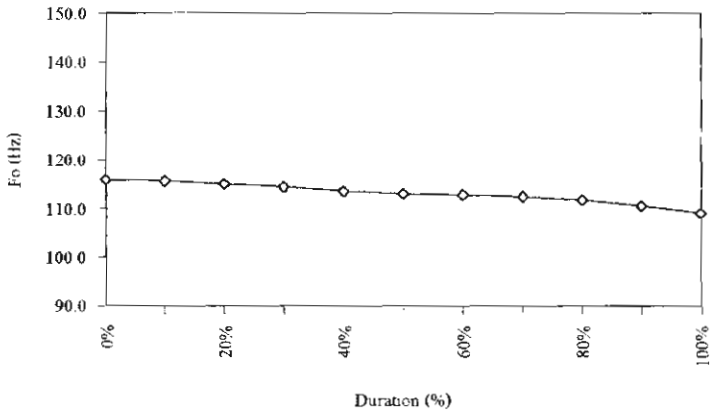


Figure 36 : ***Tone 2 of Akha pronounced by native speaker***

Ex.	[ko^{21ʔ}]	'six'
	[kɔ^{21ʔ} ʔə^{33}]	'to bite'

3.) Tone 3 : Mid - level tone [33]

The pitch pattern of this tone starts at 128.0 Hz and glides down to about 125.1 Hz (see figures 37 and 40).

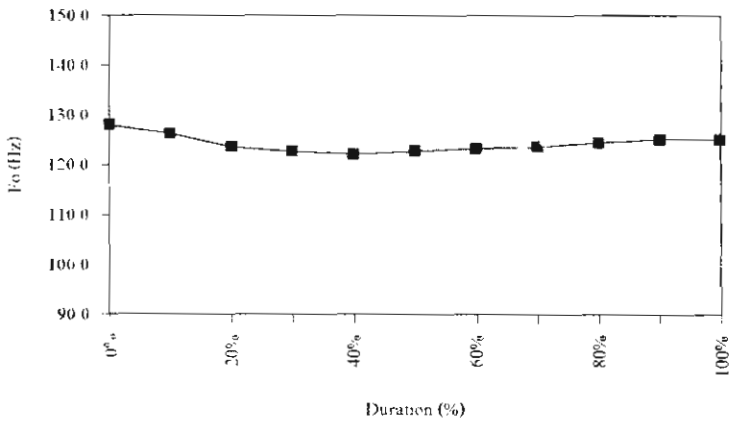


Figure 37 : ***Tone 3 of Akha pronounced by native speaker***

Ex. [sɛ^{33} p^{h}u^{55}] 'garlic'
[ba^{33} ʔə^{33}] 'to grill, to toast'

4.) Tone 4 : Mid - rising tone [34]

The pitch pattern of this tone starts at 122.6 Hz and glides up to about 138.7 Hz, then falls a little to 135.8 Hz (see figures 38 and 40).

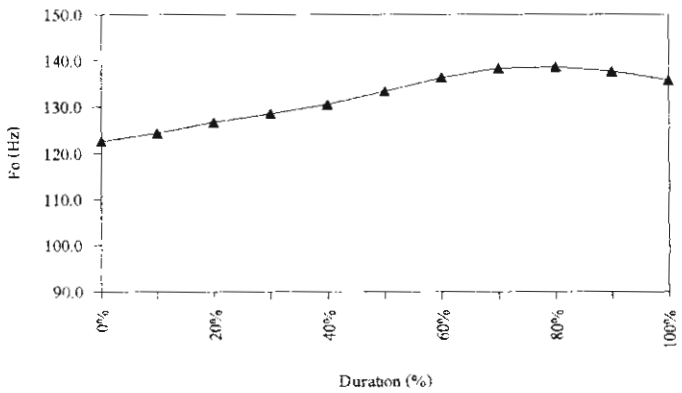


Figure 38 : ***Tone 4 of Akha pronounced by native speaker***

Ex. [ba^{21} ba^{34}] 'cheek'
[kɔ^{21} du^{34}] 'top of the mountain'

5.) Tone 5 : High - level tone [55]

The pitch pattern of this tone starts at 142.3 Hz and glides up to about 148.6 Hz, then falls a little to about 146.7 Hz (see figures 39 and 40).

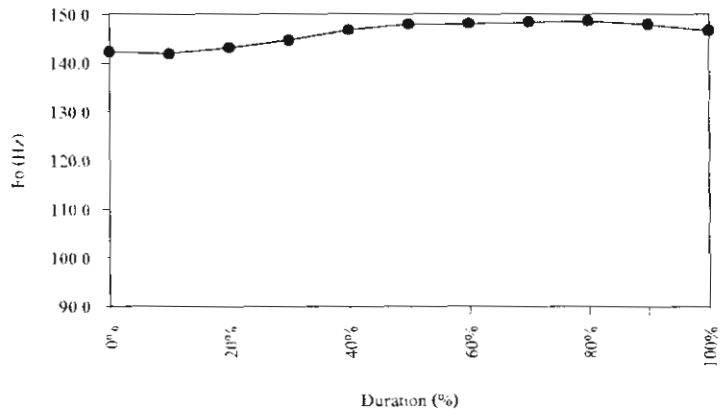


Figure 39 : ***Tone 5 of Akha pronounced by native speaker***

Ex. [bi^{55} jɔ^{21ʔ}] 'to be inclined'
[ko^{21ʔ} ts^{h}e^{55}] 'sixty'

Each tone of Akha is put into the same diagram as follows

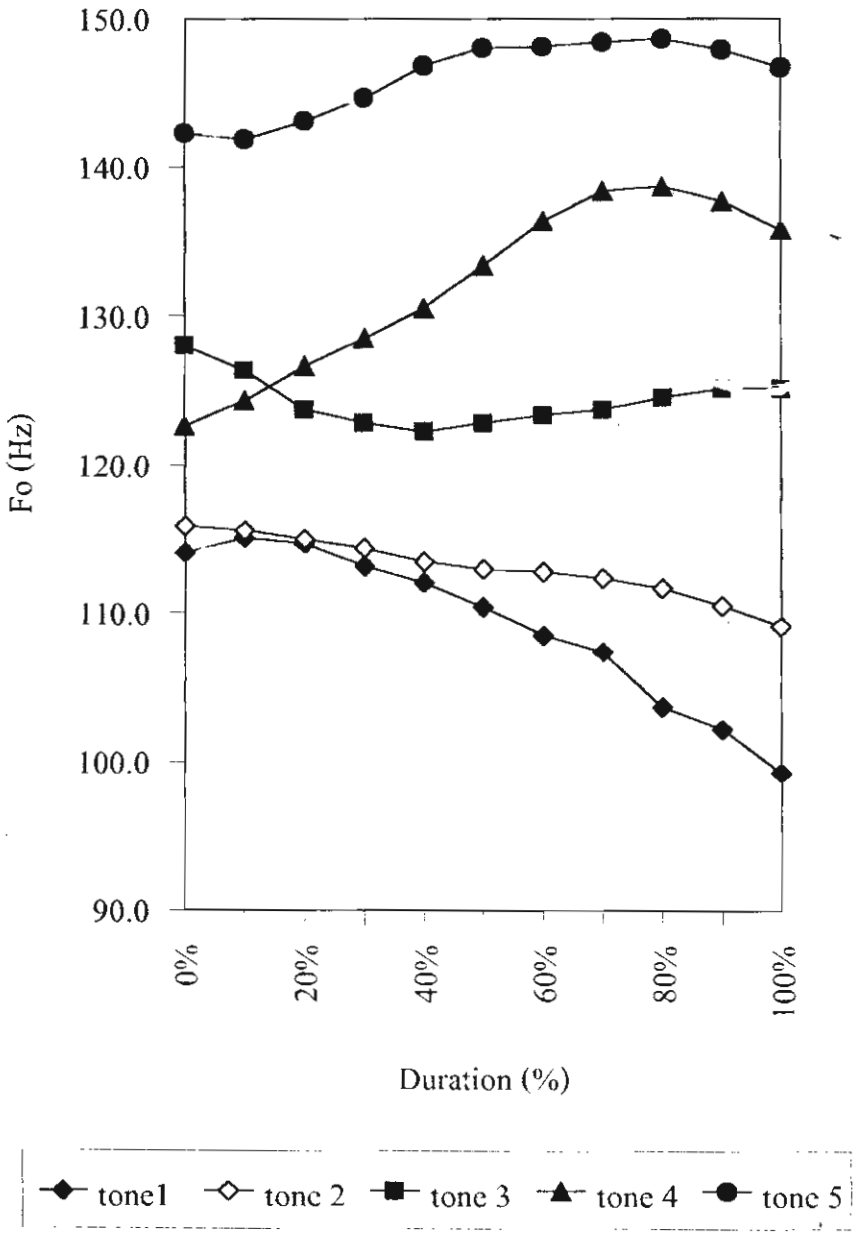


Figure 40 : ***Tone features of Akha pronounced by native speaker***

4.4 Tonal System and Tone Features of Karen

4.4.1 Tonal system

There are 6 tones in Karen as follows :

Tone 1 low - level tone
Tone 2 mid - level tone
Tone 3 high - falling tone
Tone 4 high - falling - glottalized tone
Tone 5 high - level tone
Tone 6 high - level - glottalized tone

4.4.2 Tone features

1.) Tone 1 : Low - level tone [22]

The pitch pattern of this tone starts at 92.5 Hz and glides down to about 87.0 Hz (see figures 41 and 47).

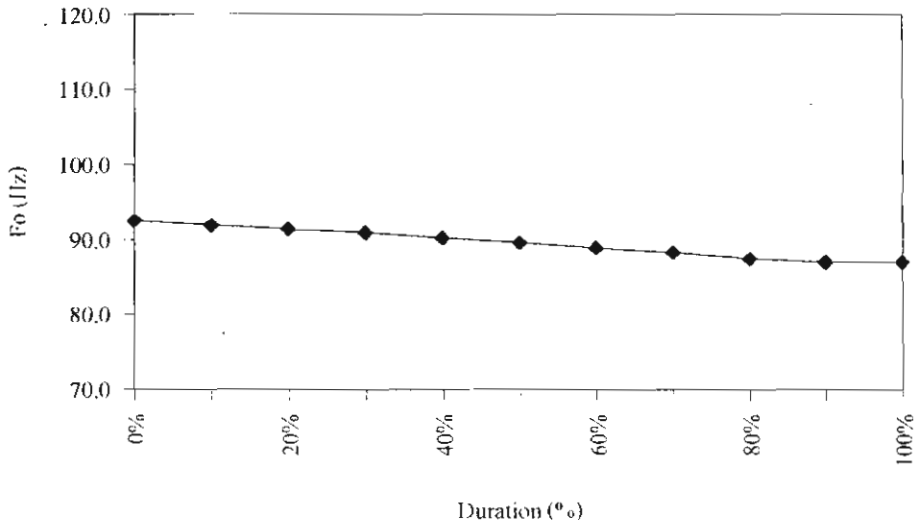


Figure 41 : ***Tone 1 of Karen pronounced by native speaker***

Ex. [me^{22}] 'rice'
[puu^{22}] 'to wash hair'

2.) Tone 2 : Mid - level tone [33]

The pitch pattern of this tone starts at 99.3 Hz and glides down to about 96.5 Hz (see figures 42 and 47).

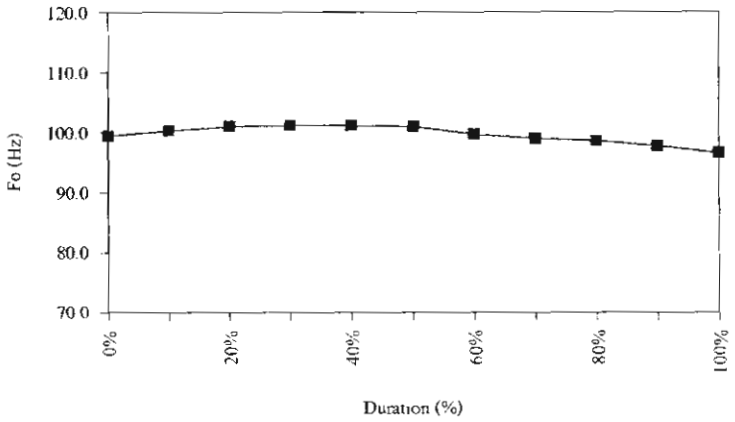


Figure 42 : ***Tone 2 of Karen pronounced by native speaker***

Ex.	[tʌ^{33}]	'one'
	[mɛ^{33}]	'tooth'

3.) Tone 3 : High - falling tone [41]

The pitch pattern of this tone starts at 106.4 Hz and falls quickly to about 76.8 Hz (see figures 43 and 47).

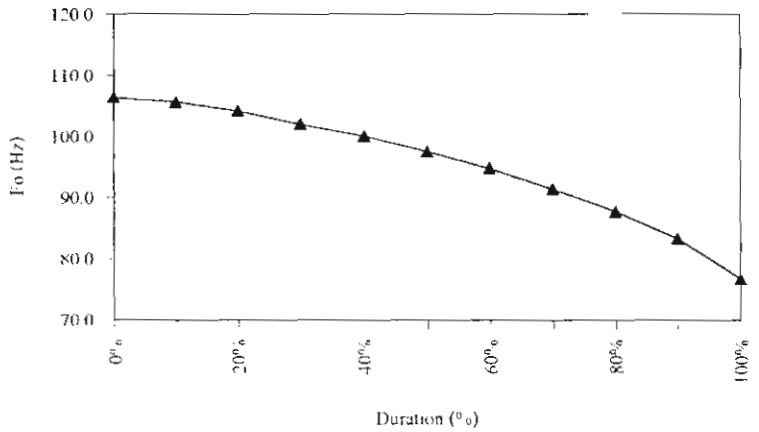


Figure 43 : ***Tone 3 of Karen pronounced by native speaker***

Ex. [mɛ^{41}] 'tail'
[me^{41}] 'correct, right'

4.) Tone 4 : High - falling - glottalized tone [42ʔ]

The pitch pattern of this tone starts at 102.8 Hz and falls quickly to about 86.1 Hz in the second section. The glottal stop is heard at the end of the tone (see figures 44 and 47).

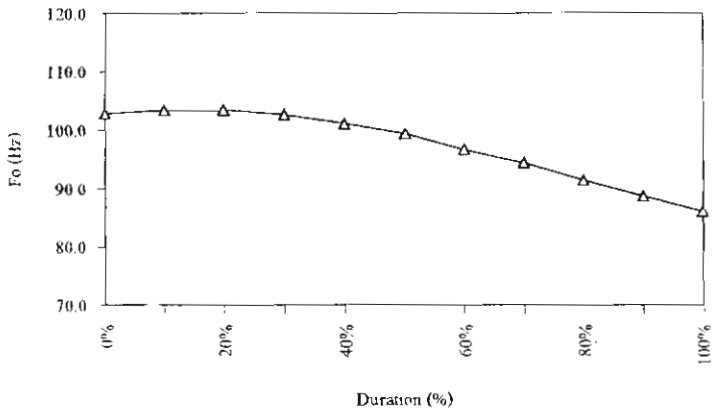


Figure 44 : ***Tone 4 of Karen pronounced by native speaker***

Ex. [me^{42ʔ} ʔu^{33}] 'fire'
[t^{h}a^{33} t^{h}a^{42ʔ}] 'to weave'

5.) Tone 5 : High - level tone [44]

The pitch pattern of this tone starts at 104.2 Hz and glides up to about 109.1 Hz (see figures 45 and 47).

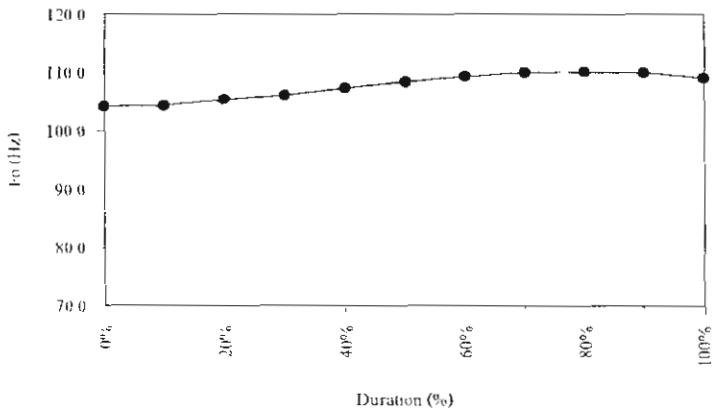


Figure 45 : ***Tone 5 of Karen pronounced by native speaker***

Ex. [mɛ^{44} tʰi^{33}] 'tear'
[pi^{44}] 'sticky'

6.) Tone 6 : High - level - glottalized tone [55ʔ]

The pitch pattern of this tone starts at 115.1 Hz and glides up to about 117.4 Hz. The glottal stop is heard at the end of the tone (see figures 46 and 47).

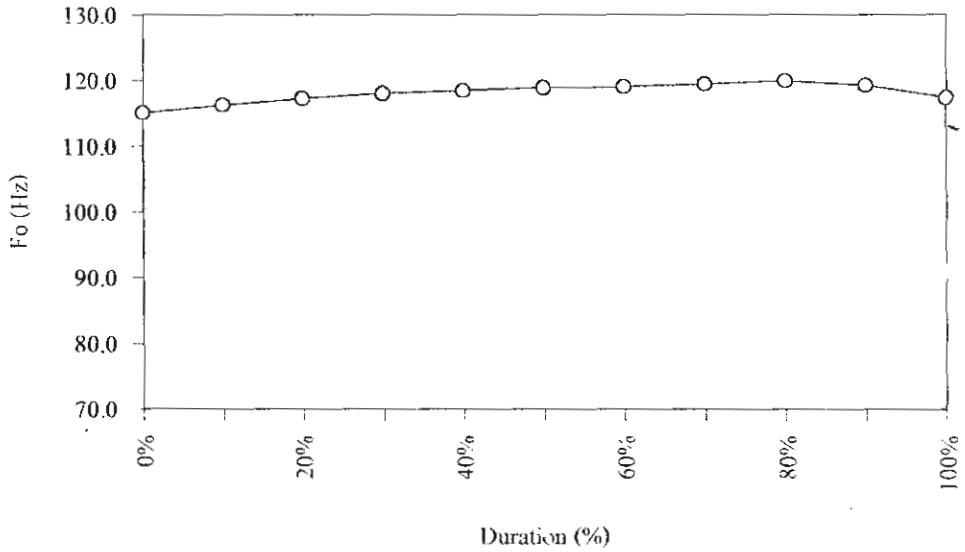


Figure 46 : ***Tone 6 of Karen pronounced by the native speaker***

Ex. [mɛ^{55ʔ}] 'sand'
[tʰa^{55ʔ}] 'iron, needle'

All the six tones of Karen are put in the following figure.

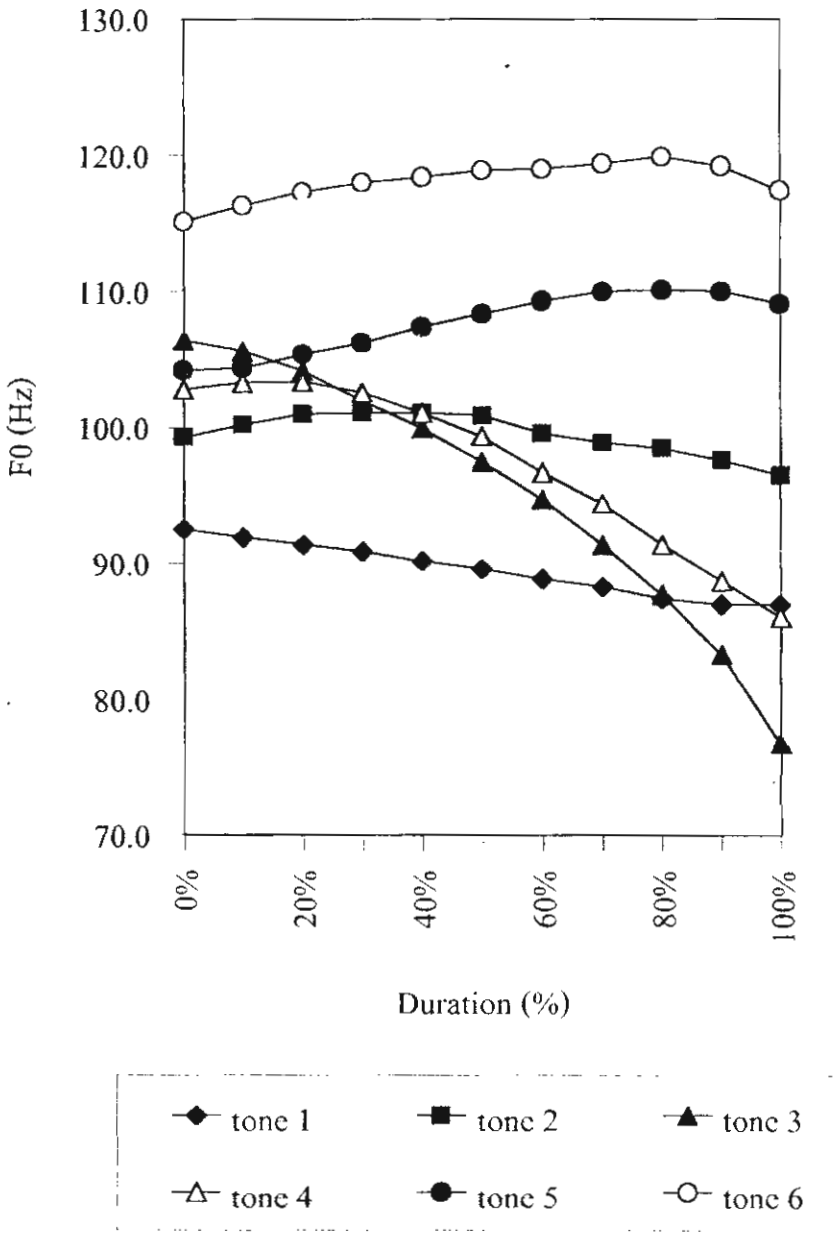


Figure 47 : ***Tone features of Karen pronounced by the native speaker***

CHAPTER V

TONAL SYSTEMS AND TONE FEATURES OF CHIANGRAI'S NORTHERN THAI DIALECT PRONOUNCED BY THE LAHU, AKHA, AND KAREN PEOPLE

The results of the analysis indicate that Chiangrai's Northern Thai dialect in citation form, Lahu and Akha have 4 tones, whereas Karen has 6 tones.

In connected speech, Lahu has 5 tones, Akha has 4 tones, and Karen has 6 tones as follows:

5.1 Tonal System and Tone Features of Chiangrai's Northern Thai Dialect Pronounced by Lahu

5.1.1 Tonal system in citation form

Regarding the number of tones, Chiangrai's Northern Thai dialect pronounced by the eight Lahu speakers have a 4 tone system. Note that they pronounce the DS4 tone as a rising tone, whereas the two Lahu speakers (Chiakue and Chachor) pronounce this tone as a falling tone in the same way as the native Chiangrai's Northern Thai speakers. It can be speculated that these two Lahu speakers speak Chiangrai's Northern Thai dialect better than the eight Lahu speakers. In calculating the average of fundamental frequency, it is necessary that the falling tone pronounced by these two Lahu speakers have to be excluded. The pattern of split and coalescence of the eight Lahu speakers may be shown as follows:

Table 17 : ***Pattern of tones in citation form of Chiangrai's Northern Thai dialect pronounced by Lahu***

A	*B*	*C*	*DL*	*DS*
Tone 1	*Tone 3*	*Tone 4*	*Tone 3*	*Tone 2*
Tone 2				

Following table 17, it is interesting to note that

(i) Tone *A* reflects the glottalization split, Tones *B* and *DL* reflect the voiced and voiceless split, whereas Tones *C* and *DS* have no split in their columns.

(ii) Tone *C* merges with Tones *B4* and *DL4*.

5.1.2 Tone features in citation form

1.) Tone 1 : Low - falling - rising tone [212]

The pitch pattern of this tone starts at 107.6 and glides down to about 97.6 Hz, then rises quickly to about 115.1 Hz (see figures 48 and 53).

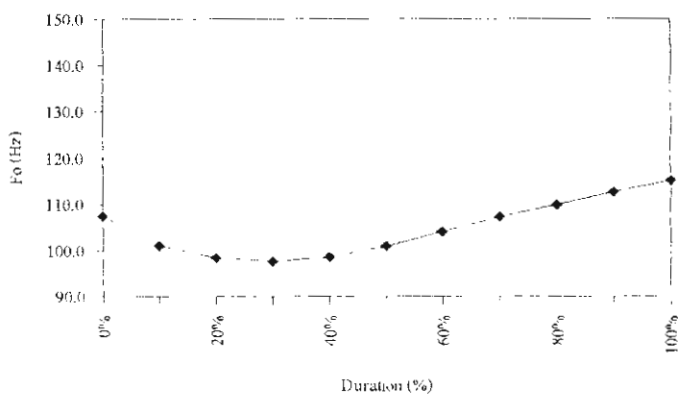


Figure 48 : ***Tone 1 in citation form of Chiangrai's Northern Thai dialect pronounced by Lahu***

Ex.	[hu:^{212}]	'ear'
	[k^{h}a:^{212}]	'leg'
	[pi:^{212}]	'year'
	[kin^{212}]	'to eat'

2.) Tone 2 has 2 allotones which are in complementary distribution as follows:

2.1) Mid - rising tone (occurs with smooth syllables) [34]

The pitch pattern of this tone starts at 119.2 Hz and glides up to about 129.9 Hz (see figures 49 and 53).

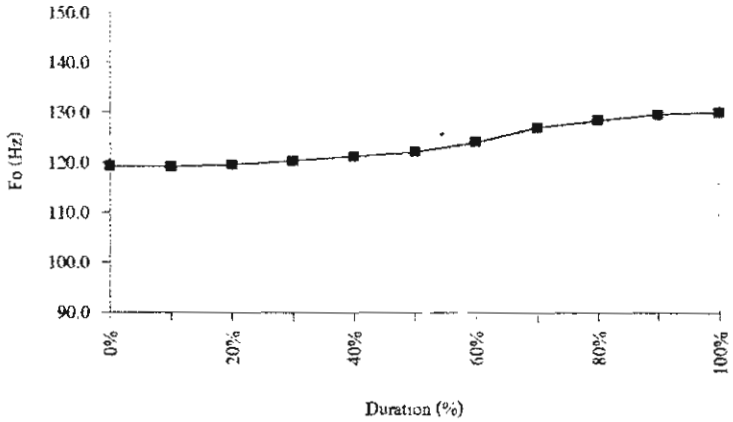


Figure 49 : ***Tone 2 on smooth syllables in citation form of Chiangrai's Northern Thai dialect pronounced by Lahu***

Ex.	[bin^{34}]	'to fly'
	[dæːŋ^{34}]	'red'
	[miː^{34}]	'hand'
	[nɔːn^{34}]	'to lie down'

2.2) High - rising tone (occurs with checked syllables) [45]

The pitch pattern of this tone starts at 133.9 Hz and glides up to about 146.2 Hz. The glottal stop is heard at the end of the tone (see figures 50 and 53).

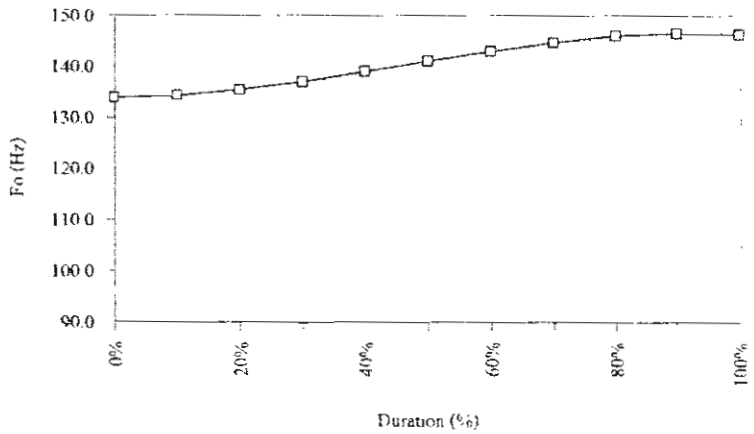


Figure 50 : ***Tone 2 on checked syllables in citation form of Chiangrai's Northern Thai dialect pronounced by Lahu***

Ex.	[$p^ha^{45?}$]	'vegetable'
	[$to^{45?}$]	'to fall'
	[$?o^{45?}$]	'chest'
	[$mo^{45?}$]	'ant'

3.) Tone 3 : Low - falling tone [21]

The pitch pattern of this tone starts at 114.6 Hz on smooth syllables and 116.8 Hz on checked syllables, then glides down to about 102.5 Hz on smooth syllables and 103.9 Hz on checked syllables. The glottal stop is heard at the end of the tone on checked syllables (see figures 51 and 53).

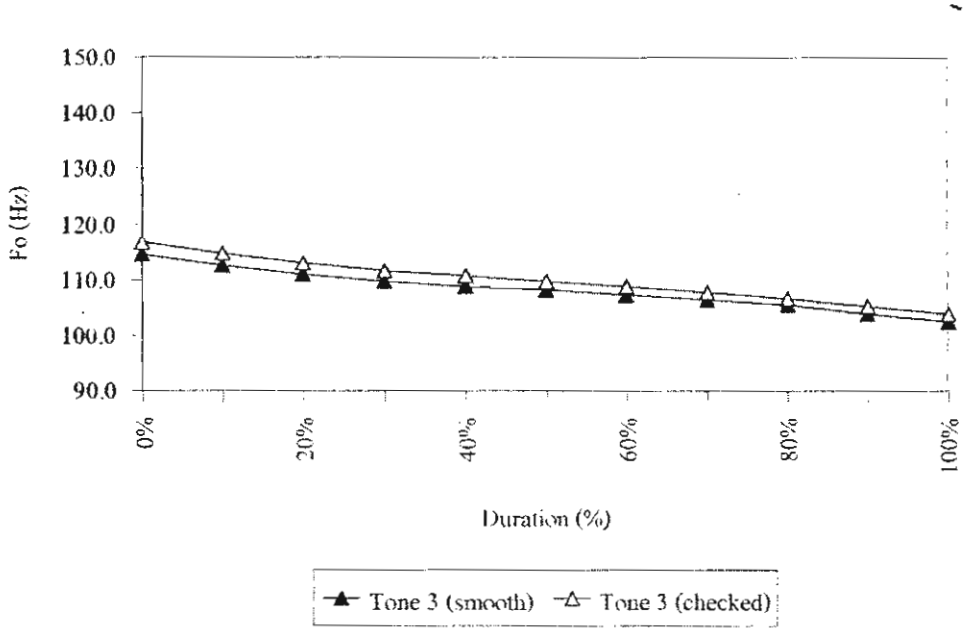


Figure 51 : ***Tone 3 on smooth and checked syllables in citation form of Chiangrai's Northern Thai dialect pronounced by Lahu***

Ex.	[$si:^{21}$]	'four'
	[taw^{21}]	'turtle'
	[$bæŋ^{21}$]	'to divide'
	[$k^ha^{21?}$]	'to be torn'
	[$kɔ^{21?}$]	'to embrace'
	[$bɔ^{21?}$]	'blind'

4.) Tone 4 : High - falling tone [52,42]

The pitch pattern of this tone starts at 144.3 Hz on smooth syllables and 131.3 Hz on checked syllables, then falls quickly to about 114.8 Hz on smooth syllables and 107.4 Hz on checked syllables. The glottal stop is heard at the end of the tone on checked syllables (see figures 52 and 53).

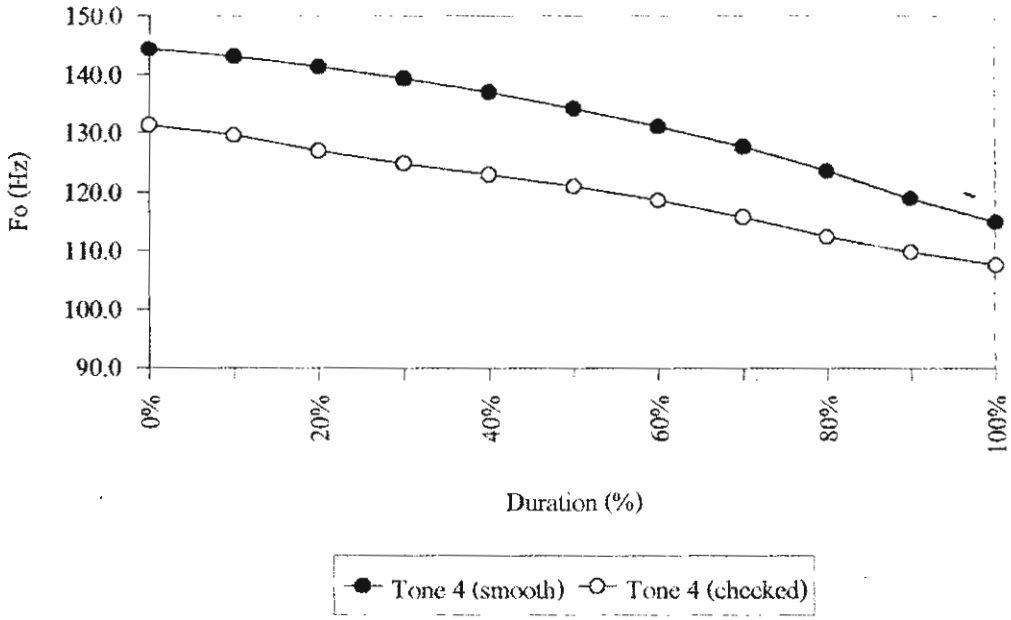


Figure 52 : ***Tone 4 on smooth and checked syllables in citation form of Chiangrai's Northern Thai dialect pronounced by Lahu***

Ex.	[pɔ:^{52}]	'father'
	[ya:^{52}]	'grass'
	[tom^{52}]	'to boil'
	[da:y^{52}]	'cord'
	[na:m^{52}]	'water'
	[lɨə^{42ʔ}]	'blood'
	[ha^{42ʔ}]	'root'

All the tones on smooth and checked syllables are put into the same diagram as follows:

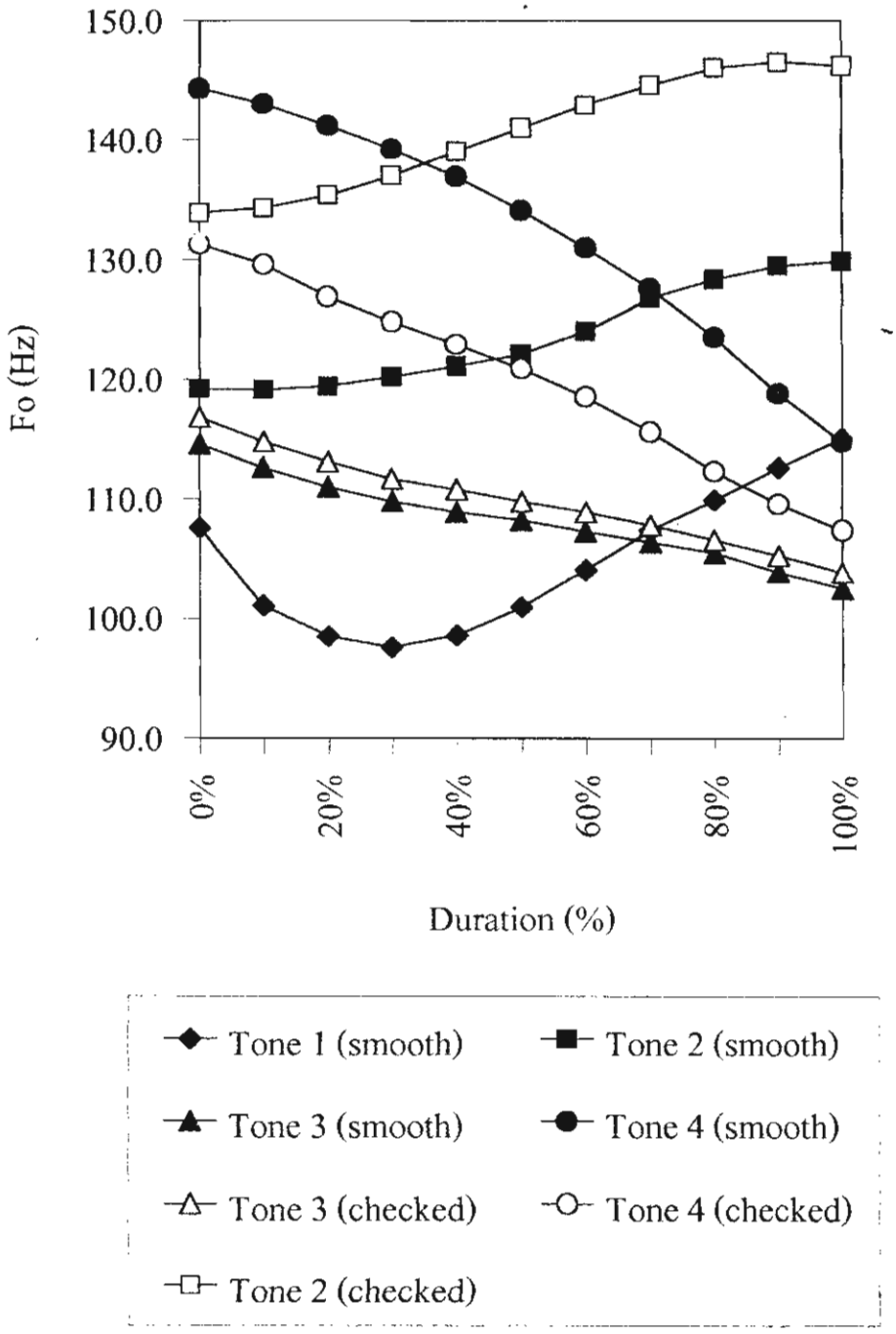


Figure 53 : ***Tone features in citation form of Chiangrai's Northern Thai dialect pronounced by Lahu***

5.1.3 Tonal system in connected speech

Regarding the number of tones, Chiangrai's Northern Thai dialect pronounced by the nine Lahu speakers have a 5 tone system. Note that they pronounce the DS1-2-3 tone as a rising tone in the same way as the native Chiangrai's Northern Thai speakers, whereas only one Lahu speaker (Chakue) pronounces this tone as a falling tone. In calculating the average of fundamental frequency, it is necessary that the falling tone pronounced by this Lahu speaker have to be excluded. The pattern of split and coalescence of the nine Lahu speakers may be shown as follows :

Table 18 : ***Pattern of tones in connected speech of Chiangrai's Northern Thai dialect pronounced by Lahu***

A	*B*	*C*	*DL*	*DS*
Tone 1	*Tone 3*	*Tone 5*	*Tone 3*	*Tone 2*
Tone 2	*Tone 4*		*Tone 4*	*Tone 5*

Following table 18, it is interesting to note that tone ***A*** reflects the glottalization split, Tones ***B***, ***DL*** and ***DS*** reflect the voiced and voiceless split, whereas Tone ***C*** has no split in its column.

5.1.4 Tone features in connected speech

1.) Tone 1 : Low - falling - rising tone [212]

The pitch pattern of this tone starts at 116.7 and glides down to about 106.1 Hz, then rises to about 124.8 Hz (see figures 54 and 61).

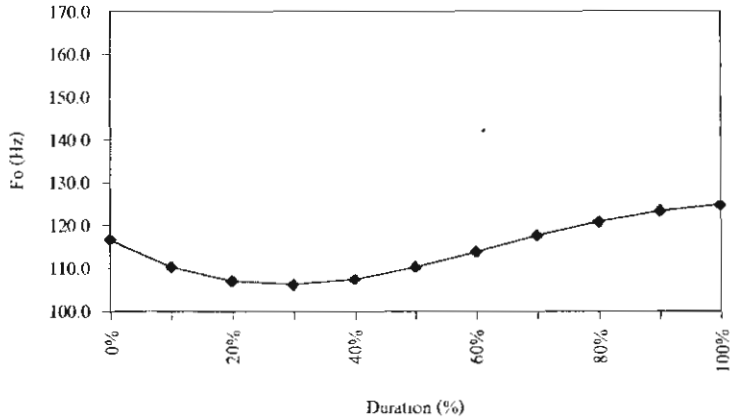


Figure 54 : ***Tone 1 in connected speech of Chiangrai's Northern Thai dialect pronounced by Lahu***

Ex.	[hu:^{212}]	'ear'
	[k^{h}a:^{212}]	'leg'
	[pi:^{212}]	'year'
	[kin^{212}]	'to eat'

2.) Tone 2 has 2 allotones which are in complementary distribution as follows:

2.1) Mid - rising tone (occurs with smooth syllables) |34|

The pitch pattern of this tone starts at 132.7 Hz and glides up to about 145.5 Hz (see figures 55 and 61).

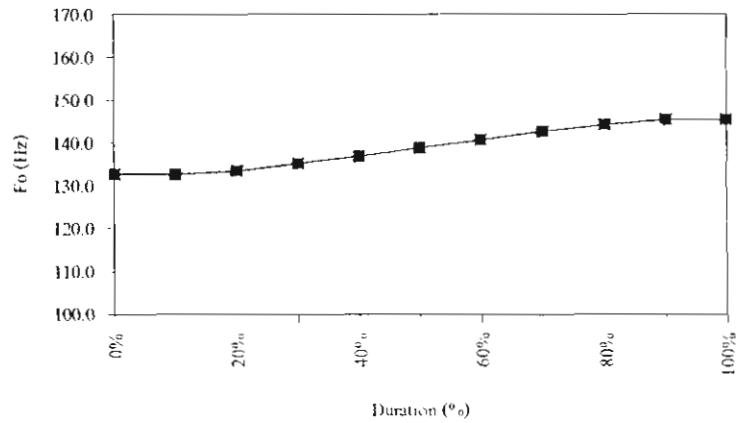


Figure 55 : ***Tone 2 on smooth syllables in connected speech of Chiangrai's Northern Thai dialect pronounced by Lahu***

Ex.	[bin^{34}]	'to fly'
	[dæːŋ^{34}]	'red'
	[miː^{34}]	'hand'
	[nɔːn^{34}]	'to lie down'

2.2) High - rising tone (occurs with checked syllables) [45]

The pitch pattern of this tone starts at 149.7 Hz and glides up to about 163.6 Hz. The glottal stop is heard at the end of the tone (see figures 56 and 61)

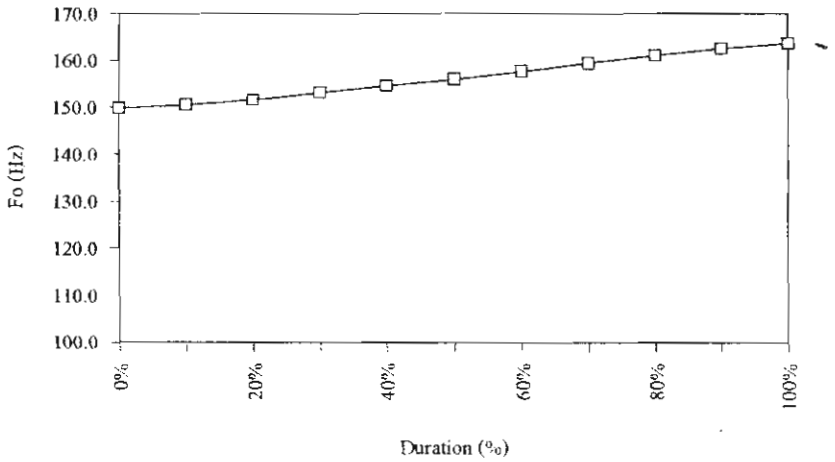


Figure 56 : ***Tone 2 on checked syllables in connected speech of Chiangrai's Northern Thai dialect pronounced by Lahu***

Ex.	[pʰa^{45ʔ}]	'vegetable'
	[to^{45ʔ}]	'to fall'
	[ʔo^{45ʔ}]	'chest'

3.) Tone 3 : Low - falling tone [21]

The pitch pattern of this tone starts at 122.0 Hz on smooth syllables and 125.2 Hz on checked syllables, then glides down to about 105.4 Hz on smooth syllables and 109.1 Hz on checked syllables. The glottal stop is heard at the end of the tone on checked syllables (see figures 57 and 61).

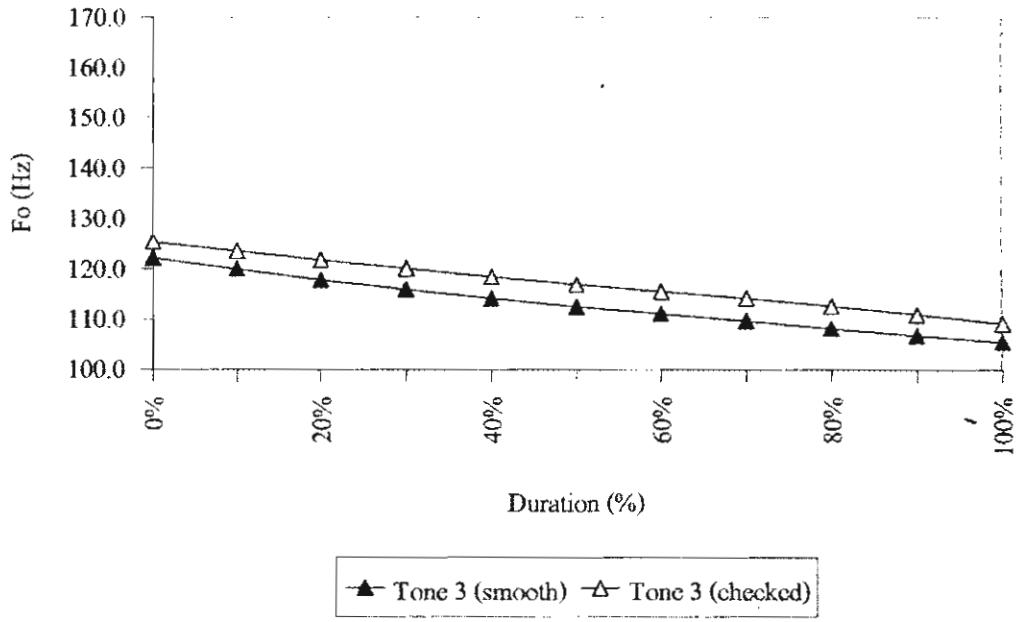


Figure 57 : ***Tone 3 on smooth and checked syllables in connected speech of Chiangrai's Northern Thai dialect pronounced by Lahu***

Ex.	[si:^{21}]	'four'
	[taw^{21}]	'turtle'
	[bæŋ^{21}]	'to divide'
	[k^{h}a^{21ʔ}]	'to be torn'
	[kɔ^{21ʔ}]	'to embrace'
	[bɔ^{21ʔ}]	'blind'

4.) Tone 4 : Mid - falling tone [31]

The pitch pattern of this tone starts at 139.5 Hz on smooth syllables and 138.8 Hz on checked syllables, then falls to about 115.3 Hz on smooth syllables and 111.1 Hz on checked syllables. The glottal stop is heard at the end of the tone on checked syllables (see figures 58 and 61).

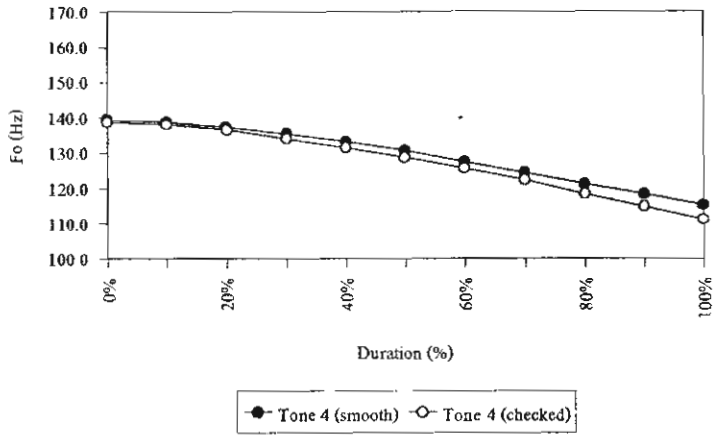


Figure 58 : ***Tone 4 on smooth and checked syllables in connected speech of Chiangrai's Northern Thai dialect pronounced by Lahu***

Ex.	[pɔː^{31}]	'father'
	[hay^{31}]	'plantation'
	[liə^{31ʔ}]	'blood'
	[ha^{31ʔ}]	'root'

5.) Tone 5 has 2 allotones which are in complementary distribution as follows:

5.1) High - low - falling tone (occurs with smooth syllables) [42]

The pitch pattern of this tone starts at 147.0 Hz and falls quickly to about 128.5 Hz (see figures 59 and 61).

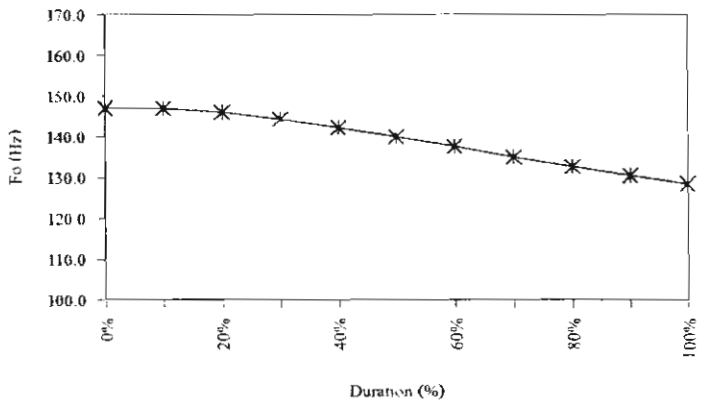


Figure 59 : ***Tone 5 on smooth syllables in connected speech of Chiangrai's Northern Thai dialect pronounced by Lahu***

Ex.	[ya:^{42}]	'grass'
	[tom^{42}]	'to boil'
	[da:y^{42}]	'cord'
	[ma:^{42}]	'horse'

5.2) High-high-falling tone (occurs with checked syllables) [54]

The pitch pattern of this tone starts at 157.4 Hz and glides down to about 147.0 Hz. The glottal stop is heard at the end of the tone (see figures 60 and 61).

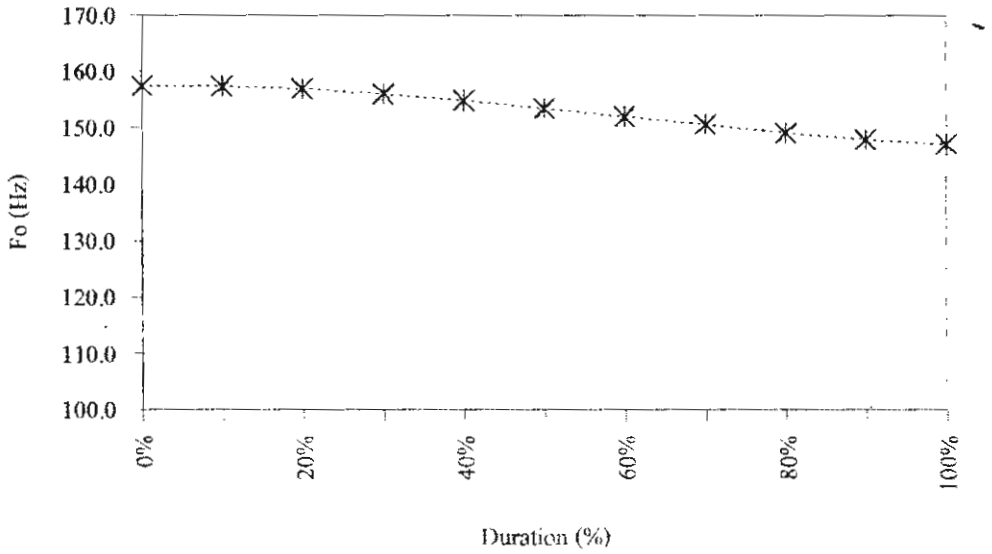


Figure 60 : ***Tone 5 on checked syllables in connected speech of Chiangrai's Northern Thai dialect pronounced by Lahu***

Ex.	[ha$^{54?}$]	'to love'
	[no$^{54?}$]	'bird'
	[wa$^{54?}$]	'temple'
	[k^{h}a$^{54?}$]	'to select'
	[le$^{54?}$]	'nail'
	[mo$^{54?}$]	'ant'

All the tones on smooth and checked syllables are put into the same diagram as follows:

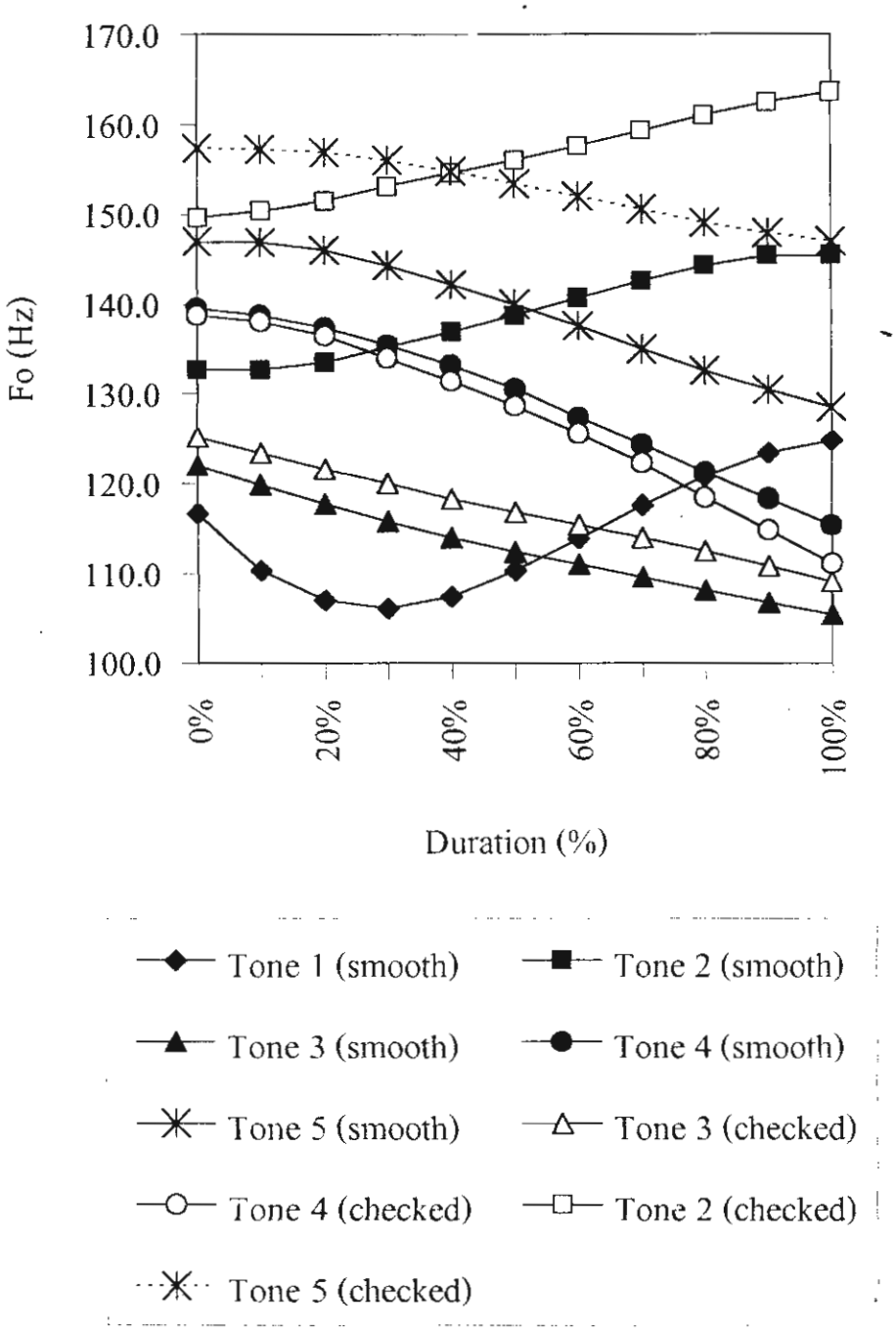


Figure 61 : ***Tone features in connected speech of Chiangrai's Northern Thai dialect pronounced by Lahu***

5.1.5 Comparison of tonal systems and tone features between citation form and connected speech

1.) Tonal system

Table 19 : ***Comparison of tonal systems between citation form and connected speech of Chiangrai's Northern Thai dialect pronounced by Lahu***

A	*B*	*C*	*DL*	*DS*
Tone 1	*Tone 3*	*Tone 4*	*Tone 3*	*Tone 2*
Tone 2				

Citation form

A	*B*	*C*	*DL*	*DS*
Tone 1	*Tone 3*	*Tone 5*	*Tone 3*	*Tone 2*
Tone 2	*Tone 4*		*Tone 4*	*Tone 5*

Connected speech

Table 19 indicates that the tonal system in citation form differs from connected speech as follows:

(i) Chiangrai's Northern Thai Dialect pronounced by Lahu, in citation form, has a 4 tone system but it has a 5 tone system in connected speech.

(ii) tone ***C***, in citation form, merges with Tones ***B4*** and ***DL4*** but in connected speech tone ***C*** does not.

(iii) tone ***DS***, in connected speech, reflects the voiced-voiceless split whereas in citation form there is no split in ***DS*** column.

2.) Tone features

Table 20 : ***Comparison of tone features between citation form and connected speech of Chiangrai's Northern Thai dialect pronounced by Lahu***

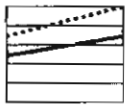
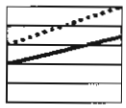
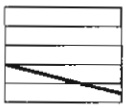
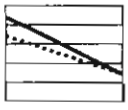
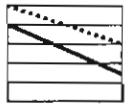
Form of Speech / Tone	**Citation form**	**Connected speech**
Tone 1	Low - falling - rising tone [212] 107.6 Hz - 97.6 Hz - 115.1 Hz 	Low - falling - rising tone [212] 116.7 Hz - 106.1 Hz - 124.8 Hz 
Tone 2	Mid - rising tone [34] (smooth) 119.2 Hz - 129.9 Hz High - rising tone [45] (checked) 133.9 Hz - 146.2 Hz 	Mid - rising tone [34] (smooth) 132.7 Hz - 145.5 Hz High - rising tone [45] (checked) 149.7 Hz - 163.6 Hz 
Tone 3	Low - falling tone [21] 114.6 Hz - 102.5 Hz (smooth) 116.8 Hz - 103.9 Hz (checked) 	Low - falling tone [21] 122.0 Hz - 105.4 Hz (smooth) 125.2 Hz - 109.1 Hz (checked) 
Tone 4	-	Mid - falling tone [31] 139.5 Hz - 115.3 Hz (smooth) 138.8 Hz - 111.1 Hz (checked) 
Tone 5	High - falling tone [52] 144.3 Hz -114.8 Hz (smooth) High - falling tone [42] 131.3 Hz - 107.4 Hz (checked) 	High - low - falling tone [42] 147.0 Hz - 128.5 Hz (smooth) High - high - falling tone [54] 157.4 Hz - 147.0 Hz (checked) 

Table 20 indicates that the tone features in citation form are different from connected speech as follows:

(i) Tone 5 in connected speech has two allotones which are in complementary distribution but in citation form, tone 5 has no allotone.

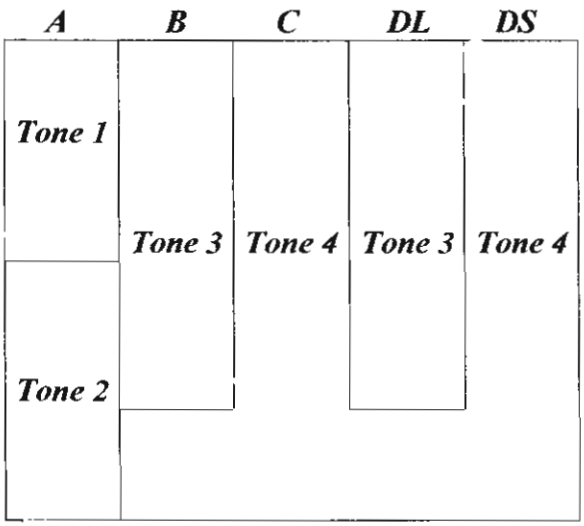
(ii) The fundamental frequencies of each tone in citation form are lower than in connected speech.

5.2 Tonal System and Tone Features of Chiangrai's Northern Thai Dialect Pronounced by Akha

5.2.1 Tonal system in citation form

Regarding the number of tones, Chiangrai's Northern Thai dialect pronounced by the seven Akha speakers have a 4 tone system. Note that they pronounce the DS1-2-3 tone as a falling tone, whereas the three Akha speakers (Akor, Acha, and Lopha) pronounce this tone as a rising tone in the same way as the native Chiangrai's Northern Thai speakers. It can be speculated that these three Akha speakers speak Chiangrai's Northern Thai dialect better than the seven Akha speakers. In calculating the average of fundamental frequency, it is necessary that the rising tone pronounced by these three Akha speakers have to be excluded. The pattern of split and coalescence of the seven Akha speakers may be shown as follows:

Table 21 : ***Pattern of tones in citation form of Chiangrai's Northern Thai dialect pronounced by Akha***



Following table 21, it is interesting to note that

(i) Tone ***A*** reflects the glottalization split. Tones ***B*** and ***DL*** reflect the voiced and voiceless split, whereas Tones ***C*** and ***DS*** have no split in their columns.

(ii) Tone ***C*** merges with Tones ***B4***, ***DL4***, and ***DS***.

5.2.2 Tone features in citation form

1.) Tone 1 : Low - falling - rising tone [212]

The pitch pattern of this tone starts at 125.9 Hz and glides down to about 116.2 Hz, then rises quickly to about 130.5 Hz (see figures 62 and 67).

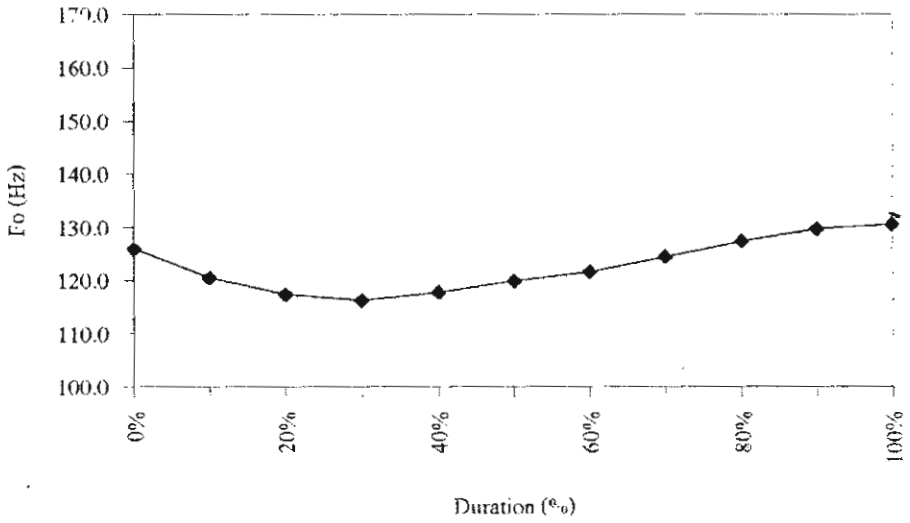


Figure 62 : ***Tone 1 in citation form of Chiangrai's Northern Thai dialect pronounced by Akha***

Ex.	[hu:^{212}]	'ear'
	[k^{h}a:^{212}]	'leg'
	[pi:^{212}]	'year'
	[kin^{212}]	'to eat'

2.) Tone 2 : Low - rising tone [23]

The pitch pattern of this tone starts at 126.5 Hz and glides up to about 137.3 Hz (see figures 63 and 67).

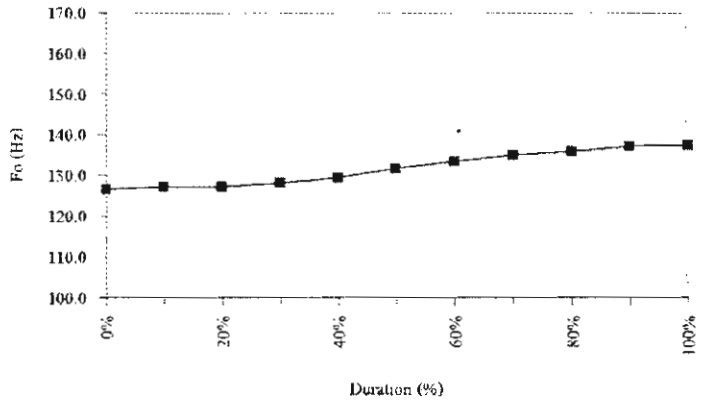


Figure 63 : ***Tone 2 in citation form of Chiangrai's Northern Thai dialect pronounced by Akha***

Ex.	[bin^{23}]	'to fly'
	[dæːŋ^{23}]	'red'
	[miː^{23}]	'hand'
	[nɔːn^{23}]	'to lie down'

3.) Tone 3 : Low - falling tone [21]

The pitch pattern of this tone starts at 130.5 Hz on smooth syllables and 131.7 Hz on checked syllables, then glides down to about 115.9 Hz on smooth syllables and 117.5 Hz on checked syllables. The glottal stop is heard at the end of the tone on checked syllables (see figures 64 and 67).

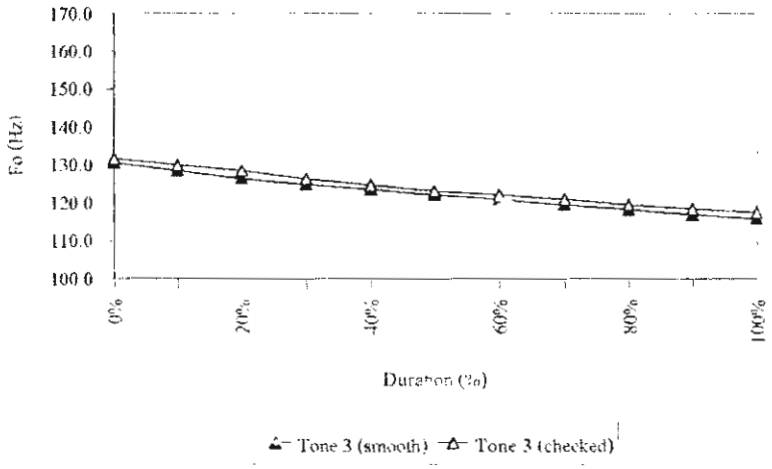


Figure 64 : ***Tone 3 on smooth and checked syllables in citation form of Chiangrai's Northern Thai dialect pronounced by Akha***

Ex.	[si:^{21}]	'four'
	[taw^{21}]	'turtle'
	[bæŋ^{21}]	'to divide'
	[k^{h}a^{21ʔ}]	'to be torn'
	[kɔ^{21ʔ}]	'to embrace'
	[bɔ^{21ʔ}]	'blind'

4.) Tone 4 has 2 allotones which are in complementary distribution as follows:

4.1) High-low-falling tone (occurs with smooth and long-checked syllable) [52, 51]

The pitch pattern of this tone starts at 154.4 Hz on smooth syllables and 155.5 Hz on long-checked syllables, then falls quickly to about 128.3 Hz on smooth syllables and 121.3 Hz on long-checked syllables. The glottal stop is heard at the end of the tone on long checked syllables (see figures 65 and 67).

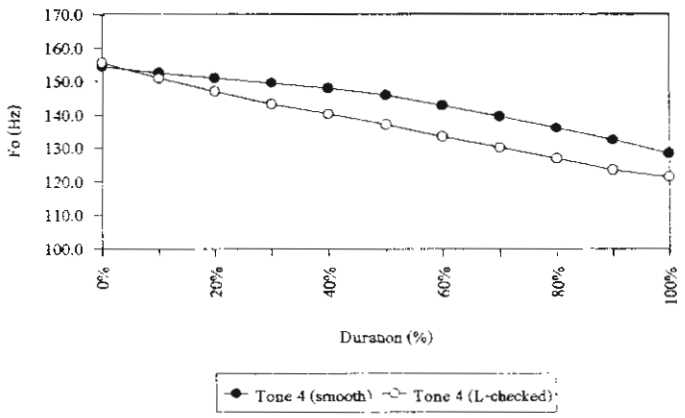


Figure 65 : ***Tone 4 on smooth and long - checked syllables in citation form of Chiangrai's Northern Thai dialect pronounced by Akha***

Ex.	[pɔ:^{52}]	'father'
	[ya:^{52}]	'grass'
	[tom^{52}]	'to boil'
	[da:y^{52}]	'cord'
	[na:m^{52}]	'water'
	[liə^{51ʔ}]	'blood'
	[ha^{51ʔ}]	'root'

4.2) High-high-falling tone (occurs with short-checked syllable) |54|

The pitch pattern of this tone starts at 161.1 Hz and glides down to about 142.1 Hz. The glottal stop is heard at the end of the tone (see figures 66 and 67).

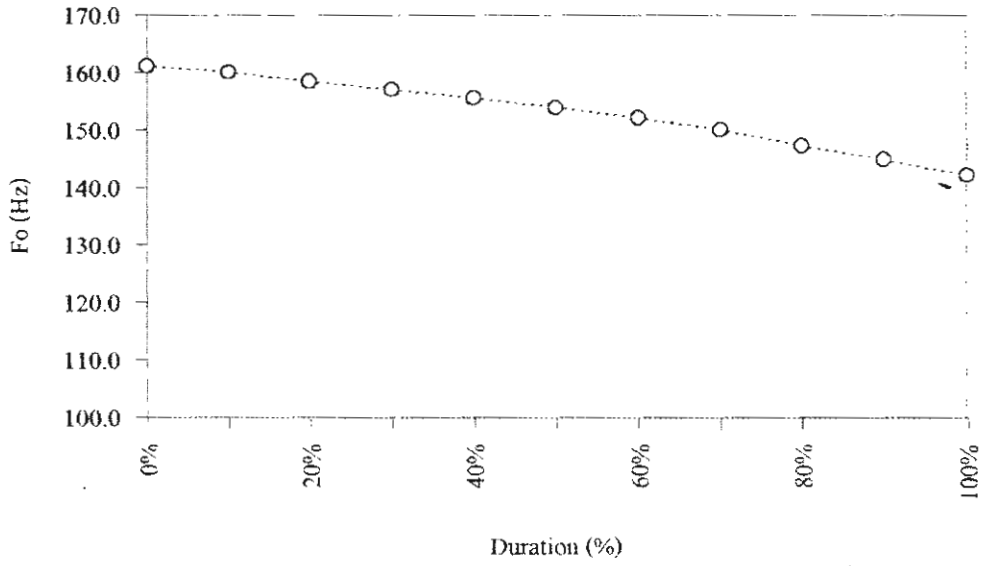


Figure 66 : ***Tone 4 on short - checked syllables in citation form of Chiangrai's Northern Thai dialect pronounced by Akha***

Ex.	[$p^ha^{54?}$]	'vegetable'
	[$to^{54?}$]	'to fall'
	[$?o^{54?}$]	'chest'
	[$mo^{54?}$]	'ant'

All the tones on smooth and checked syllables are put into the same diagram as follows:

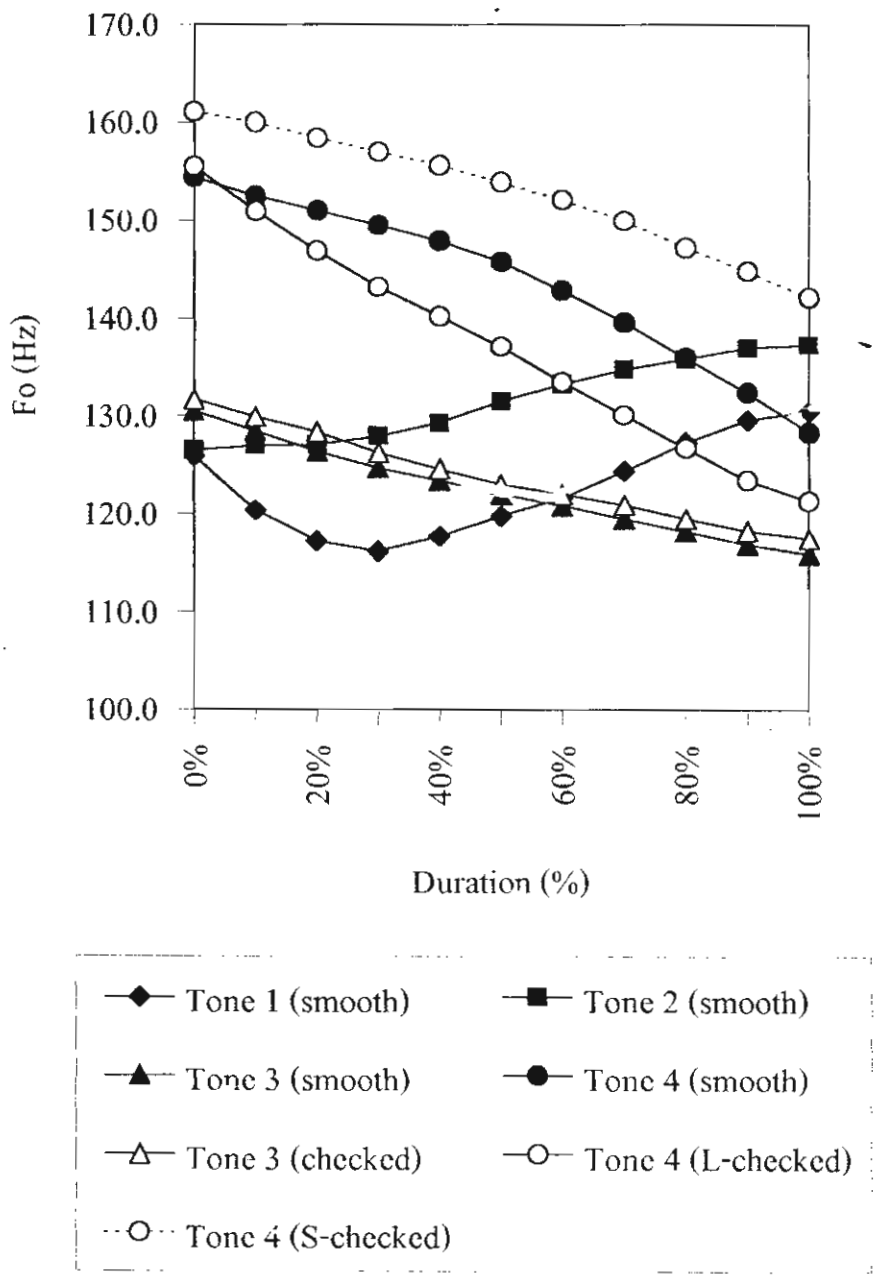


Figure 67 : ***Tone features in citation form of Chiangrai's Northern Thai dialect pronounced by Akha***

5.2.3 Tonal system in connected speech

Regarding the number of tones, Chiangrai's Northern Thai dialect pronounced by the nine Akha speakers have a 4 tone system. Note that they pronounce the DS1-2-3 tone as a falling tone, whereas only one Akha speaker (Akor) pronounces this tone as rising tone in the same way as the native Chiangrai's Northern Thai speakers. In calculating the average of fundamental frequency, it is necessary that the rising tone pronounced by this Akha speaker have to be excluded. The pattern of split and coalescence of the nine Akha speakers may be shown as follows:

Table 22 : ***Pattern of tones in connected speech of Chiangrai's Northern Thai dialect pronounced by Akha***

A	*B*	*C*	*DL*	*DS*
Tone 1	*Tone 3*	*Tone 4*	*Tone 3*	*Tone 4*
Tone 2				

Following table 22, it is interesting to note that

(i) Tone ***A*** reflects the glottalization split. Tones ***B*** and ***DL*** reflect the voiced and voiceless split, whereas Tones ***C*** and ***DS*** have no split in their columns.

(ii) Tone ***C*** merges with Tones ***R4***, ***DL4***, and ***DS***.

5.2.4 Tone features in connected speech

1.) Tone 1 : Low - falling - rising tone [212]

The pitch pattern of this tone starts at 120.0 Hz and glides down to about 109.0 Hz, then rises quickly to about 130.3 Hz (see figures 68 and 73).

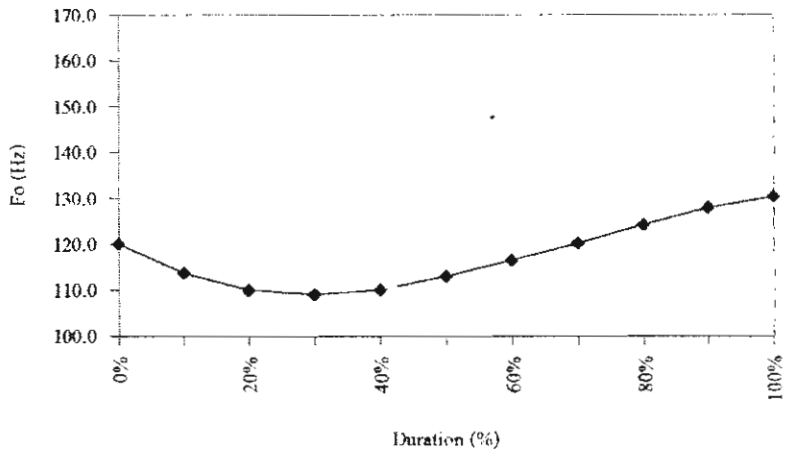


Figure 68 : ***Tone 1 in connected speech of Chiangrai's Northern Thai dialect pronounced by Akha***

Ex.	[hu:^{212}]	'ear'
	[k^{h}a:^{212}]	'leg'
	[pi:^{212}]	'year'
	[kin^{212}]	'to eat'

2.) Tone 2 : Mid - rising tone [34]

The pitch pattern of this tone starts at 141.5 Hz and glides up to about 156.1 Hz (see figures 69 and 73).

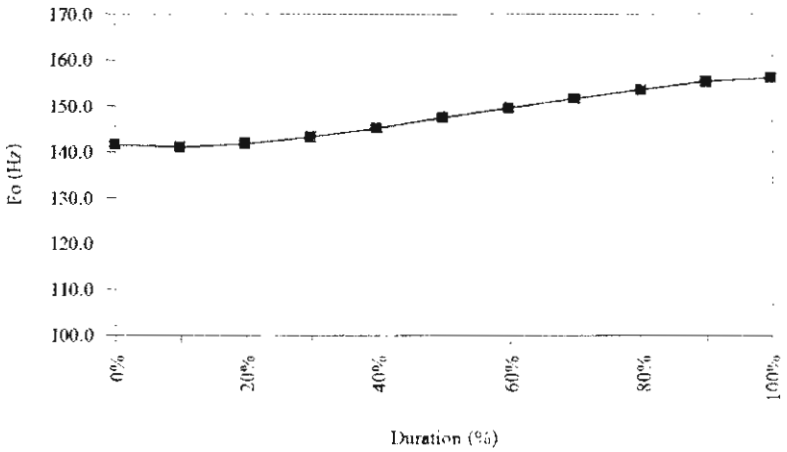


Figure 69 : ***Tone 2 in connected speech of Chiangrai's Northern Thai dialect pronounced by Akha***

Ex.	[bin^{34}]	'to fly'
	[dæːŋ^{34}]	'red'
	[miː^{34}]	'hand'
	[nɔːn^{34}]	'to lie down'

3.) Tone 3 : Low - falling tone [21]

The pitch pattern of this tone starts at 127.9 Hz on smooth syllables and 129.7 Hz on checked syllables, then glides down to about 114.1 Hz on smooth syllables and 114.2 Hz on checked syllables. The glottal stop is heard at the end of the tone on checked syllables (see figures 70 and 73).

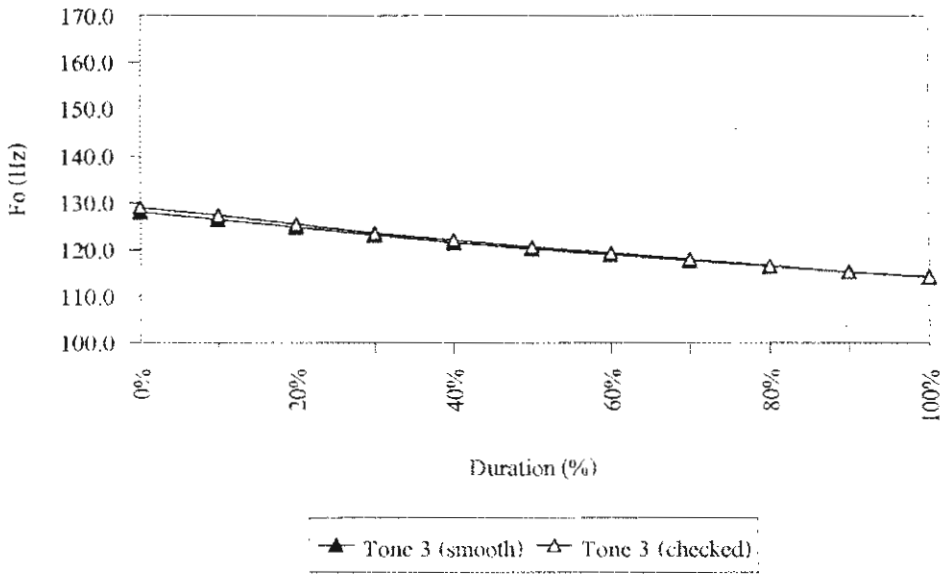


Figure 70 : *Tone 3 on smooth and checked syllables in connected speech of Chiangrai's Northern Thai dialect pronounced by Akha*

Ex.	[siː^{21}]	'four'
	[taw^{21}]	'turtle'
	[bæŋ^{21}]	'to divide'
	[kʰa^{21ʔ}]	'to be torn'
	[kɔ^{21ʔ}]	'to embrace'
	[bɔ^{21ʔ}]	'blind'

4.) Tone 4 has 2 allotones which are in complementary distribution as follows:

4.1) High-low-falling tone (occurs with smooth and long-checked syllable) [42]

The pitch pattern of this tone starts at 147.7 Hz on smooth syllables and 144.1 Hz on long-checked syllables, then falls quickly to about 129.4 Hz on smooth syllables and 123.6 Hz on long-checked syllables. The glottal stop is heard at the end of the tone on long-checked syllables (see figures 71 and 73).

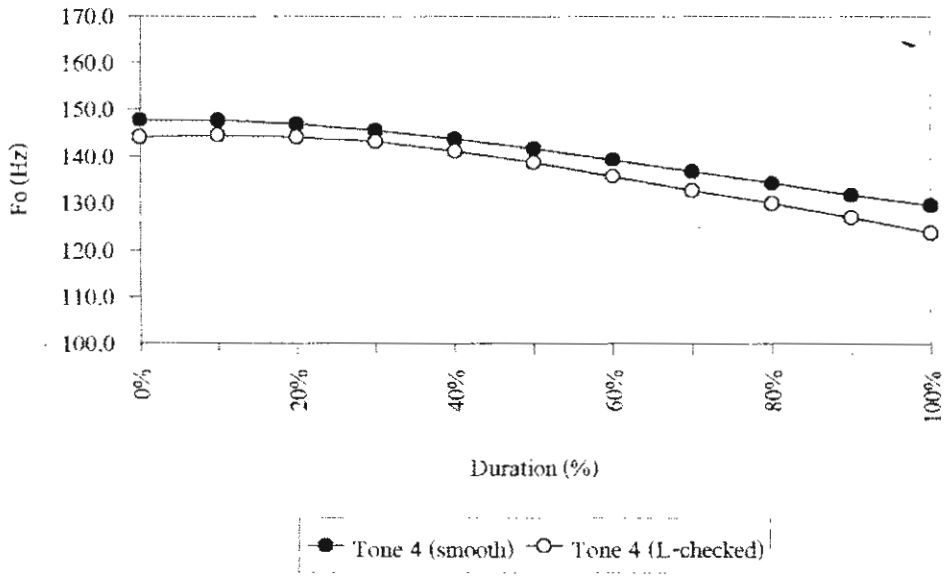


Figure 71 : ***Tone 4 on smooth and long-checked syllables in connected speech of Chiangrai's Northern Thai dialect pronounced by Akha***

Ex.	[pɔ:^{42}]	'father'
	[ya:^{42}]	'grass'
	[tom^{42}]	'to boil'
	[da:y^{42}]	'cord'
	[na:ɪn^{42}]	'water'
	[liə^{42ʔ}]	'blood'
	[ha^{42ʔ}]	'root'

4.2) High-high-falling tone (occurs with short-checked syllable) |54|

The pitch pattern of this tone starts at 170.3 Hz and glides down to about 155.1 Hz. The glottal stop is heard at the end of the tone (see figures 72 and 73).

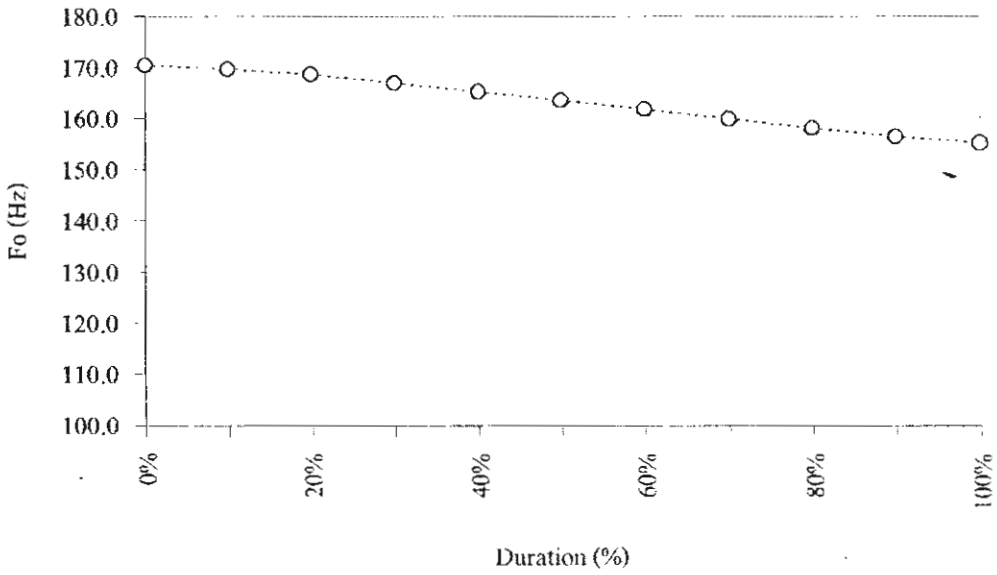


Figure 72 : ***Tone 4 on short - checked syllables in citation form of Chiangrai's Northern Thai dialect pronounced by Akha***

Ex.	[$p^ha^{54ʔ}$]	'vegetable'
	[$to^{54ʔ}$]	'to fall'
	[$ʔo^{54ʔ}$]	'chest'
	[$mo^{54ʔ}$]	'ant'

All the tones on smooth and checked syllables are put into the same diagram as follows:

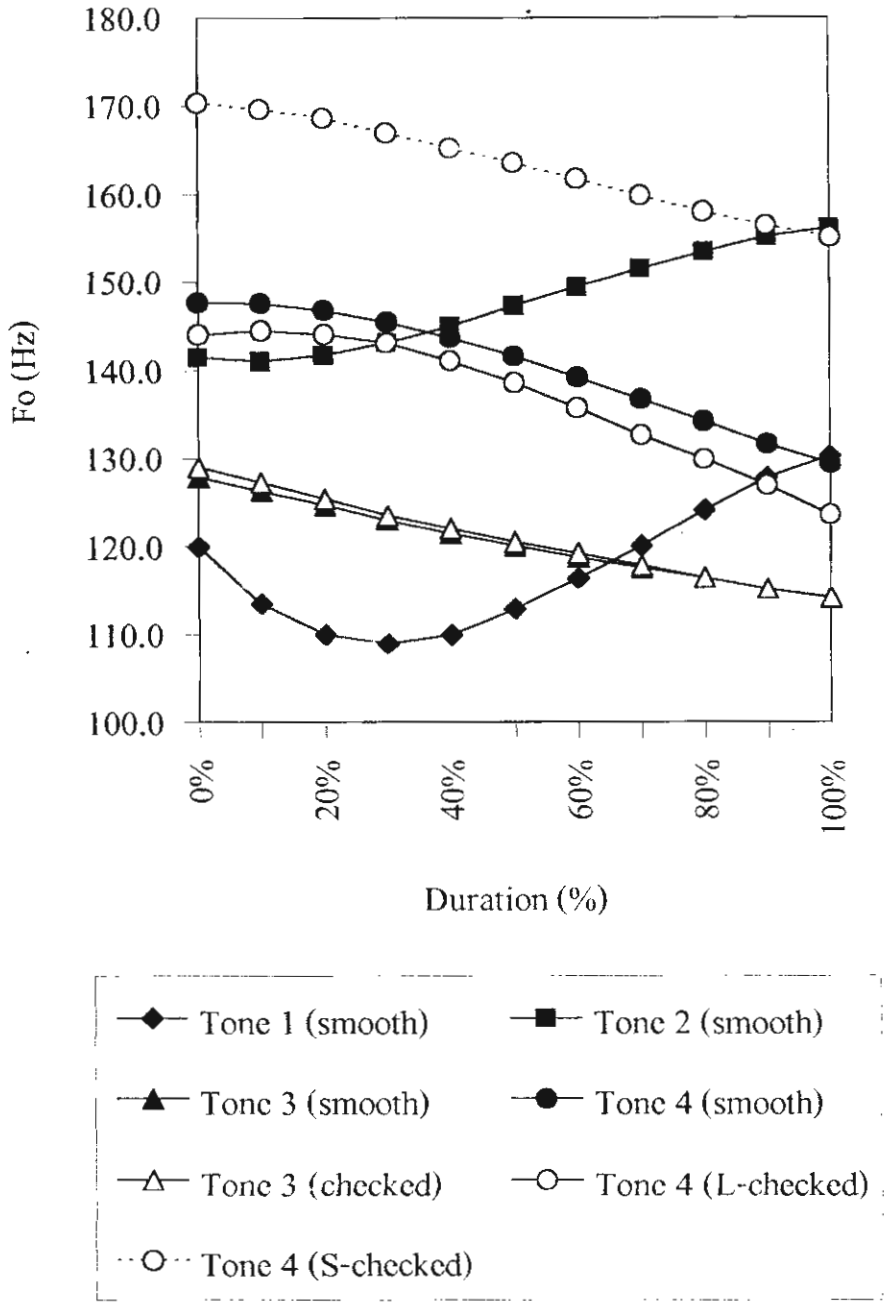


Figure 73 : ***Tone features in connected speech of Chiangrai's Northern Thai dialect pronounced by Akha***

5.2.5 Comparison of tonal systems and tone features between citation form and connected speech

1.) Tonal system

Table 23 : ***Comparison of tonal systems between citation form and connected speech of Chiangrai's Northern Thai dialect pronounced by Akha***

A	*B*	*C*	*DL*	*DS*
Tone 1	*Tone 3*	*Tone 4*	*Tone 3*	*Tone 4*
Tone 2				

Citation form

A	*B*	*C*	*DL*	*DS*
Tone 1	*Tone 3*	*Tone 4*	*Tone 3*	*Tone 4*
Tone 2				

Connected speech

Table 23 indicates that the tonal system in citation form and connected speech are the same as follows:

(i) Tone *A* reflects the glottalization split. Tones ***B*** and ***DL*** reflect the voiced-voiceless split, whereas Tones ***C*** and ***DS*** have no split in their columns.

(ii) Tone *C* merges with Tones ***B4***, ***DL4***, and ***DS***.

2.) Tone features

Table 24 : ***Comparison of tone features between citation form and connected speech of Chiangrai's Northern Thai dialect pronounced by Akha***

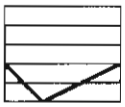
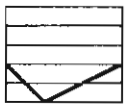
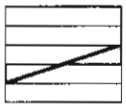
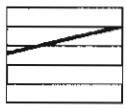
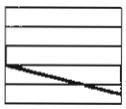
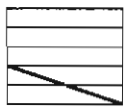
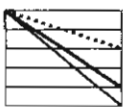
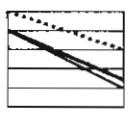
Form of Speech / Tone	**Citation form**	**Connected speech**
Tone 1	Low - falling - rising tone [212] 125.9 Hz - 116.2 Hz 130.5 Hz 	Low - falling - rising tone [212] 120.0 Hz - 109.0 Hz - 130.3 Hz 
Tone 2	Low - rising tone [23] 126.5 Hz -137.3 Hz 	Mid - rising tone [34] 141.5 Hz - 156.1 Hz 
Tone 3	Low - falling tone [21] 130.5 Hz -115.9 Hz (smooth) 131.7 Hz - 117.5 Hz (checked) 	Low - falling tone [21] 127.9 Hz - 114.1 Hz (smooth) 129.0 Hz - 114.2 Hz (checked) 
Tone 4	High - low - falling tone [52] 154.4 Hz - 128.3 Hz (smooth) High - low - falling tone [51] 155.5 Hz - 121.3 Hz (L-checked) High - high - falling tone [54] 161.1 Hz - 142.1 Hz (S-checked) 	High - low - falling tone [42] 147.7 Hz - 129.4 Hz (smooth) 144.1 Hz - 123.6 Hz (L-checked) High - high - falling tone [54] 170.3 Hz - 155.1 Hz (S-checked) 

Table 24 indicates that the tone features in citation form are different from connected speech as follows:

(i) Tone 2, in citation form, is low-rising tone, but in connected speech, it is mid - rising tone.

(ii) The pitch pattern of tone 4 on smooth and long-checked syllables, in citation form, starts at the fifth section of the voice range, but in connected speech, it starts at the fourth section.

5.3 Tonal System and Tone Features of Chiangrai's Northern Thai Dialect Pronounced by Karen

5.3.1 Tonal system in citation form

Regarding the number of tones, Chiangrai's Northern Thai dialect pronounced by eight Karen speakers have a 6 tone system. Note that they pronounce the DS1-2-3 tone as a rising tone in the same way as the native Chiangrai's Northern Thai speakers, whereas two Karen speakers (Dikuhae and Kampan) pronounce this tone as a falling tone. In calculating the average of fundamental frequency, it is necessary that the falling tone pronounced by these two Karen speakers have to be excluded. The pattern of split and coalescence of the eight Karen speakers may be shown as follows:

Table 25 : ***Pattern of tones in citation form of Chiangrai's Northern Thai dialect pronounced by Karen***

A	*B*	*C*	*DL*	*DS*
Tone 1	*Tone 3*	*Tone 5*	*Tone 3*	*Tone 2*
Tone 2	*Tone 4*	*Tone 6*	*Tone 4*	*Tone 5*

Following table 25, the tonal system, it is interesting to note that tone ***A*** reflects the glottalization split and the tones in other columns, ***B***, ***C***, ***DL***, and ***DS***, always reflect the voiced-voiceless split.

5.3.2 Tone features in citation form

1) Tone 1 : Low - falling - rising tone [212]

The pitch pattern of this tone starts at 105.0 Hz and glides down to about 92.2 Hz, then rises quickly to about 107.5 Hz (see figures 74 and 82).

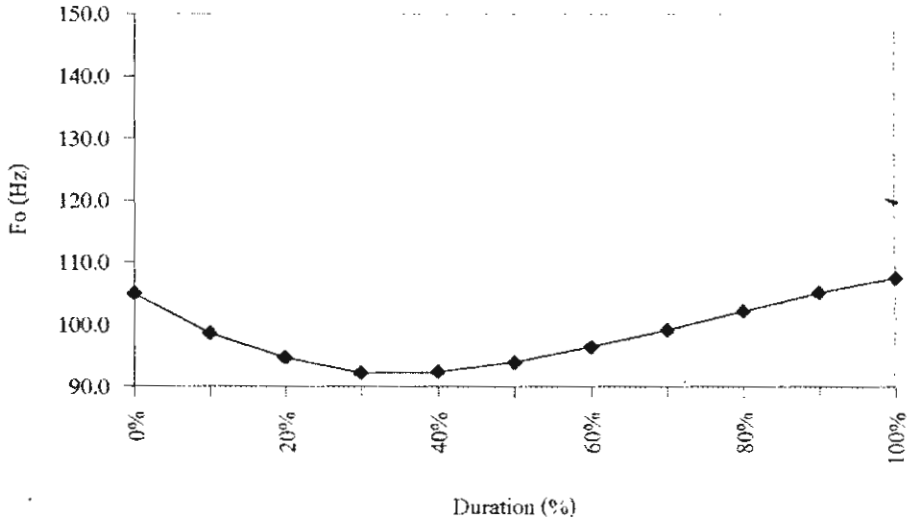


Figure 74 : ***Tone 1 in citation form of Chiangrai's Northern Thai dialect pronounced by Karen***

Ex.	[hu:^{212}]	'ear'
	[k^{h}a:^{212}]	'leg'
	[pi:^{212}]	'year'
	[kin^{212}]	'to eat'

2.) Tone 2 has 2 allotones which are in complementary distribution as follows:

2.1) Low - rising tone (occurs with smooth syllables) [24]

The pitch pattern of this tone starts at 112.1 Hz and glides up to about 124.8 Hz (see figures 75 and 82).

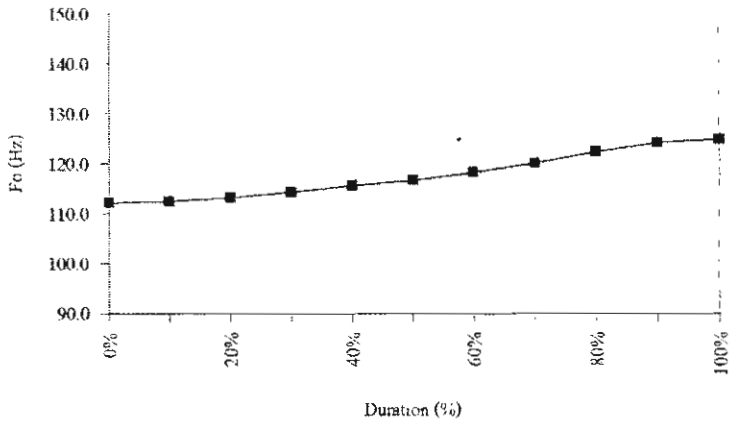


Figure 75 : ***Tone 2 on smooth syllables in citation form of Chiangrai's Northern Thai dialect pronounced by Karen***

Ex.	[bin^{24}]	'to fly'
	[dæːŋ^{24}]	'red'
	[miː^{24}]	'hand'
	[nɔːn^{24}]	'to lie down'

2.2) Mid - rising tone (occurs with checked syllables) [35]

The pitch pattern of this tone starts at 122.4 Hz and rises to about 135.4 Hz. The glottal stop is heard at the end of the tone (see figures 76 and 82).

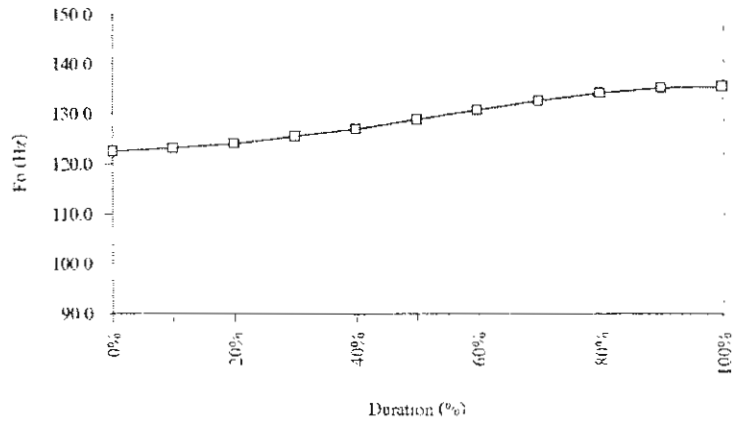


Figure 76 : ***Tone 2 on checked syllables in citation form of Chiangrai's Northern Thai dialect pronounced by Karen***

Ex.	[$p^ha^{35?}$]	'vegetable'
	[$si^{35?}$]	'ten'
	[$to^{35?}$]	'to fall'
	[$?o^{35?}$]	'chest'

3.) Tone 3 : Low - falling tone [21]

The pitch pattern of this tone starts at 113.9 Hz on smooth syllables and 113.2 Hz on checked syllables, then glides down a little to about 101.4 Hz on smooth syllables and 101.5 Hz on checked syllables. The glottal stop is heard at the end of the tone on checked syllables (see figures 77 and 82).

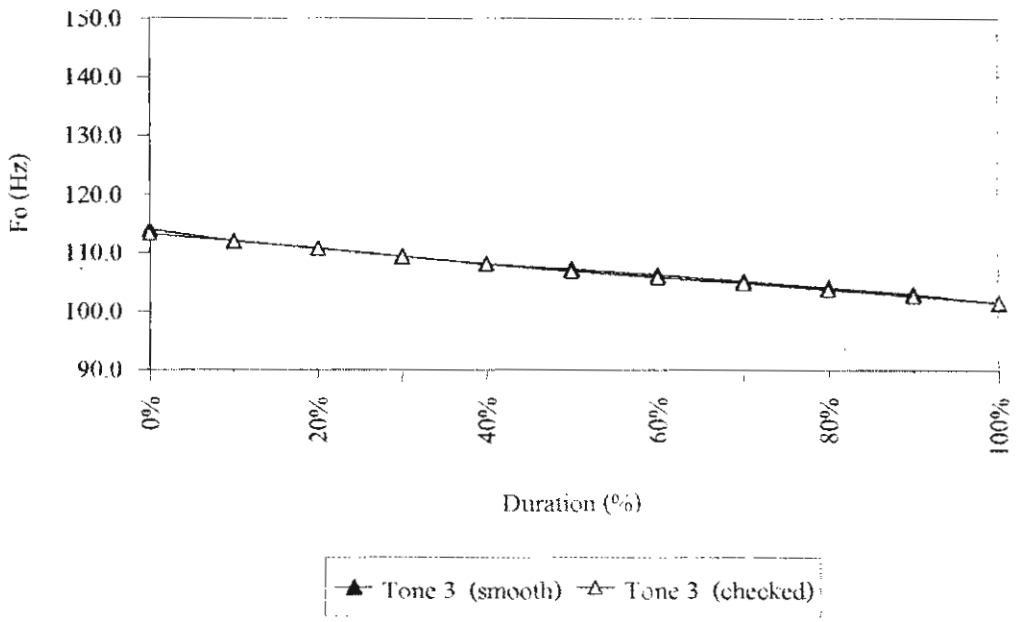


Figure 77 : *Tone 3 on smooth and checked syllables in citation form of Chiangrai's Northern Thai dialect pronounced by Karen*

Ex.	[$si:^{21}$]	'four'
	[taw^{21}]	'turtle'
	[$bæŋ^{21}$]	'to divide'
	[$k^ha^{21?}$]	'to be torn'
	[$kɔ^{21?}$]	'to embrace'
	[$bɔ^{21?}$]	'blind'

4.) Tone 4 : Mid - falling tone [31]

The pitch pattern of this tone starts at 123.5 Hz on smooth syllables and 124.0 Hz on checked syllables, then falls to about 96.9 Hz on smooth syllables and 101.5 Hz on checked syllables. The glottal stop is heard at the end of the tone on checked syllables (see figures 78 and 82).

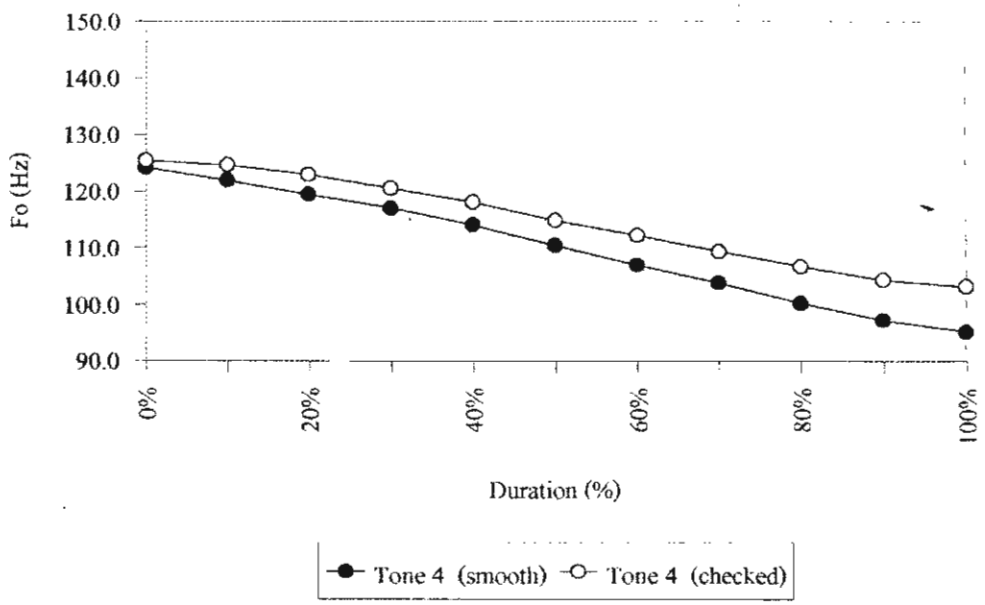


Figure 78 : ***Tone 4 on smooth and checked syllables in citation form of Chiangrai's Northern Thai dialect pronounced by Karen***

Ex.	[pɔː^{31}]	'father'
	[hay^{31}]	'plantation'
	[lɨə^{31ʔ}]	'blood'
	[ha^{31ʔ}]	'root'

5.) Tone 5 has 2 allotones which are in complementary distribution as follows:

5.1) High-mid-falling tone (occurs with smooth syllables) [43]

The pitch pattern of this tone starts at 129.7 Hz and glides down to about 116.2 Hz (see figures 79 and 82).

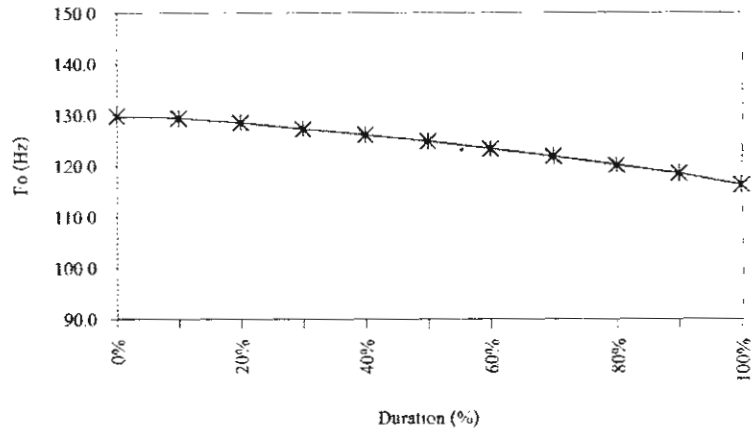


Figure 79 : ***Tone 5 on smooth syllables in citation form of Chiangrai's Northern Thai dialect pronounced by Karen***

Ex.	[ya:^{43}]	'grass'
	[ka:w^{43}]	'nine'
	[tom^{43}]	'to boil'
	[da:y^{43}]	'cord'

5.2) High-high-falling tone (occurs with checked syllables) [54]

The pitch pattern of this tone starts at 141.7 Hz and glides down to about 129.7 Hz. The glottal stop is heard at the end of the tone (see figures 80 and 82).

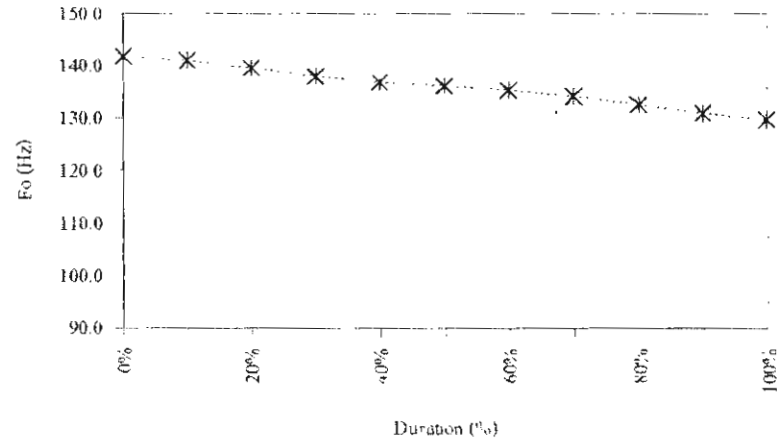


Figure 80 : ***Tone 5 on checked syllables in citation form of Chiangrai's Northern Thai dialect pronounced by Karen***

Ex.	[ha$^{54?}$]	'to love'
	[no$^{54?}$]	'bird'
	[wa$^{54?}$]	'temple'
	[k^{h}a$^{54?}$]	'to select'
	[le$^{54?}$]	'nail'
	[mo$^{54?}$]	'ant'

6.) Tone 6 : High - low falling tone [52]

The pitch pattern of this tone starts at 146.3 Hz and falls quickly to about 104.6 Hz (see figures 81 and 82).

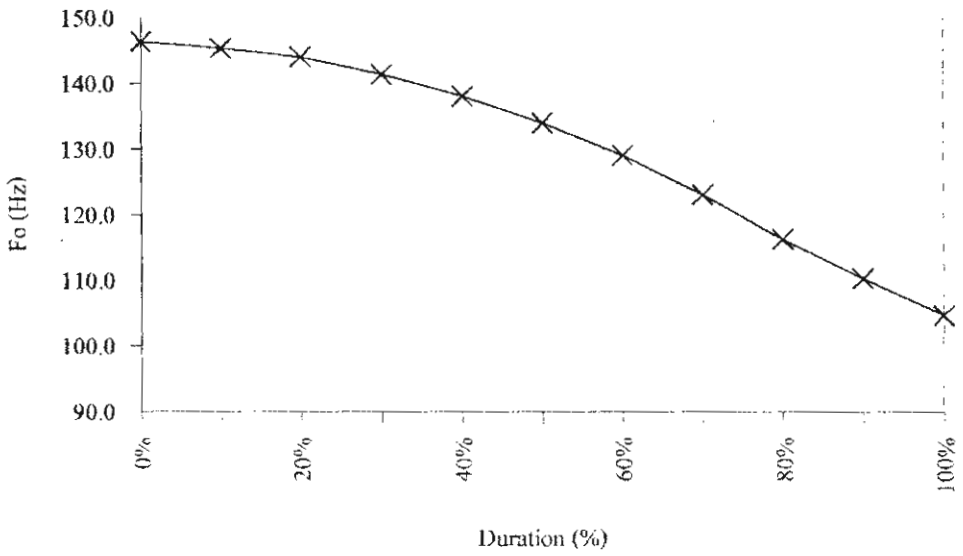


Figure 81 : ***Tone 6 in citation form of Chiangrai's Northern Thai dialect pronounced by Karen***

Ex.	[kiw^{52}]	'eyebrows'
	[tɔːŋ^{52}]	'stomach'
	[naːm^{52}]	'water'
	[lin^{52}]	'tongue'
	[maː^{52}]	'horse'

All the tones on smooth and checked syllables are put into the same diagram as follows:

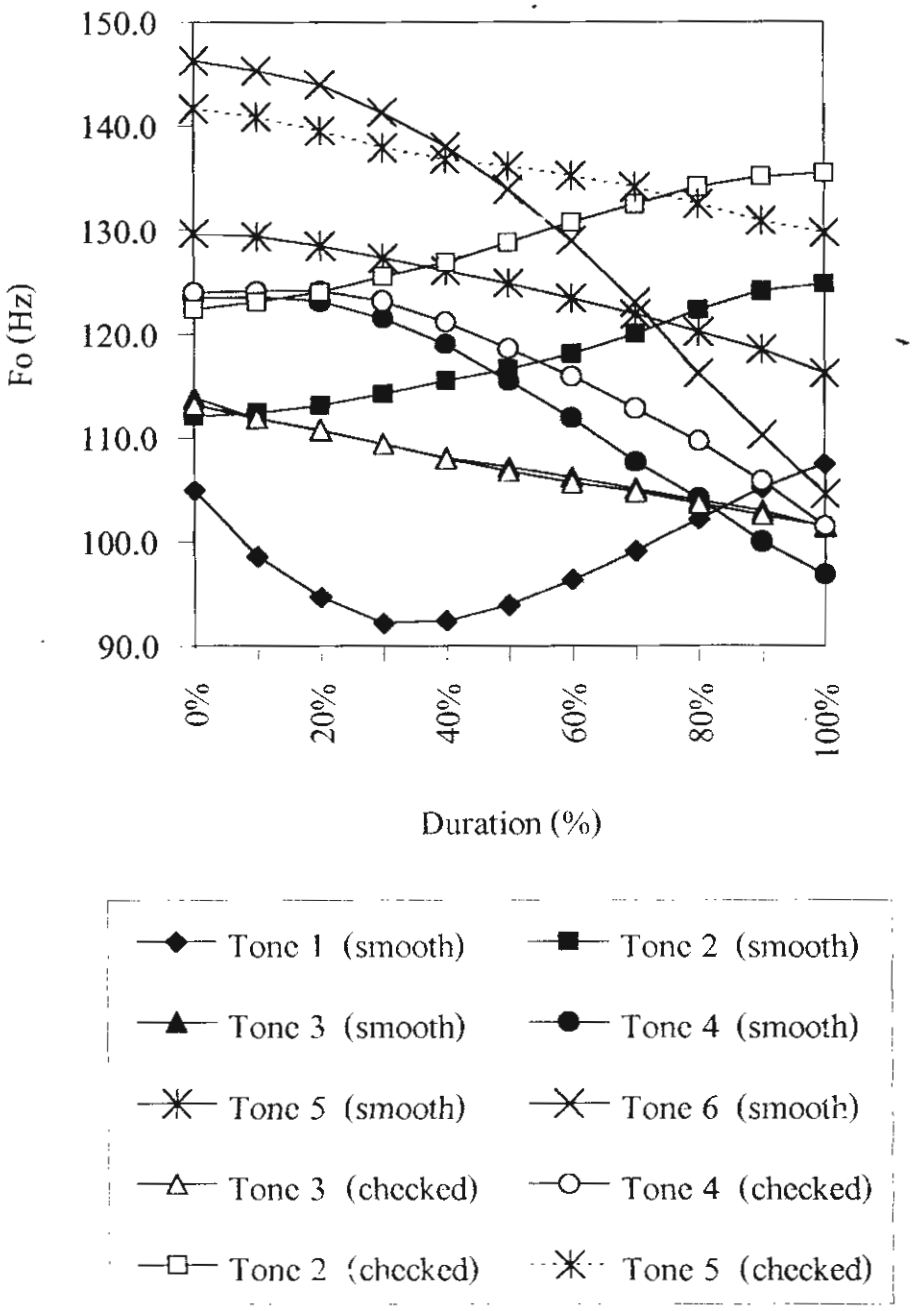


Figure 82 : ***Tone features in citation form of Chiangrai's Northern Thai dialect pronounced by Karen***