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Intonation Patterns in Native and Non-Native Arabic Speakers

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I. INTRODUCTION

Speech is a distinctive dynamic motor activity that allows us to convey our ideas and emotions as well as react to and exert control over our surroundings. Both segmental and suprasegmental elements can be found in our speech. Segmental features, such as consonants and vowels that occur in a specific temporal order, are the distinguishing units that can be heard or physically heard in the stream of speech (Crystal, 2003). As defined by their phonetic quality, suprasegmental features are features that can be arranged in contrastive patterns over multiple segments of time (Lehiste, 1970).

Prosodic qualities, such as intonation, stress, and rhythm, are also referred to as suprasegmental features (Lee & Nusbaum, 1993). Pitch, volume, and duration all contribute to the occurrence of these meaningful contrastive units in speech. Suprasegmental characteristics are crucial to voice generation and perception in human communication. Additionally, suprasegmental features are crucial for expressing pragmatic meaning at the sentence level. The utterance will have additional meaning when prosodic elements are integrated with the lexical meaning of phrases (Ladd, 1996).

Human intonation is significantly affected by suprasegmental features. Intonation is described as "the combination of tonal features into larger structural units associated with the acoustic parameter of voice fundamental frequencies and its distinctive variations in the speech process" (Botinis, Granstroem & Moebius, 2001). It aids in conveying information in speech that is not dependent on individual words or their sounds. The pitch changes over time in an utterance are known as intonation. As a result, it is intimately tied to timing patterns, volume, and occasionally vocal quality (Nolan, 2014).

Many scholars have remarked that early childhood is when intonation development begins. According to research, intonation development begins at the age of three months. The development of intonation during the early stages of life is indicated by variations in vocalisation patterns and pitch range. The fundamental frequency of the child's utterances has changed, and their duration has become more uniform, according to studies. Additionally, it was discovered that newborns' reflex unmotivated crying differed from their motivated crying (Lewis, 1951; Menyuk, 1971).

Research in Bilinguals is one of the current trends. The study of suprasegmental features in bilingual subjects, particularly in Indian context is rare. Bilingualism is commonly defined as the use of at least two languages by an individual (ASHA, 2004). The use of and proficiency in two languages may change depending on the opportunities to use the languages and exposure to the other users of languages. Bilingualism can be simultaneous or sequential. Simultaneous bilingualism occurs when a young child has exposure to two languages from birth and sequential bilingualism occurs when an individual has had exposure to second language usually after the age of 3 and after the first language is well established (ASHA, 2004).

Every language has its own and unique intonation system and certain correlations exist between intonation patterns with special meanings. Research tells us that the difficulties in the learning of L2 intonation patterns are often due to the non-equivalence of the intonation structure of the learners' L1 and the L2 structure (Cruz-Ferreira, 1983). The transfer of the intonation from native language into non-native can be beneficial. The ability to borrow one's pre-existing knowledge of one language can helpfully speed up the acquisition process of another. In other situations, comprehensive application of knowledge from the other language can be detrimental (Albin, 2015).

Intonation also helps in conveying the attitudes of a speaker such as warning, surprise, boredom and neutrality (Crystal, 1982). It also provides the listener with information about the speaker, including aspects of their identity (gender, age), emotional or affective state (happy, sad, angry), general health and social rules (Munson, 2006).

Mathew and Bhat (2010) investigated the emotional prosody in Malayalam and Hindi and the results reported that there are differences and similarities in the FO patterns across the different emotions.

The area of intonation development, use of intonation and the relationship between L1 and L2 is attracting researchers. Some studies highlight the differences in acoustic features, while some show very few changes. However the studies focus on children, who are simultaneously bilingual. The present study attempts to explore the features of intonation in Malayalam speakers, who are learning and using Arabic as their needed language. It is imperative to study the nature of intonation used in various structures and contexts, since intonation serves several communication roles and facilitates the other dimensions of communication. Hence, it is also important to look into the aspects of intonation patterns in different languages when it is spoken by native and non-native speakers.

II. REVIEW OF LITERATURE

Suprasegmental features of speech are the units superimposed on the segmental elements to impart greater meaning to the message. The constituents of these suprasegmental features include intonation, stress, rhythm, speech rate, and pause. Among suprasegmental features, intonation is the most prominent and conveys most of the semantic load of an utterance. All the languages across the globe are characterized by intonation which has its own internal constituents. Suprasegmental feature of speech is multifaceted. It is not a single homogeneous entity, but has many features (pitch, loudness, duration and pauses) and components (Intonation, Tempo, Stress, and Rhythm) (Crystal, 1981).

There is a general belief that children will acquire prosody particularly intonation very early in life, even before first words are acquired. Cruz- Ferreira (2006) reported that when listening to babies babbling, one clearly gets the impression that the child is talking in a particular language using a language-appropriate melody though, the use of language-appropriate melody doesn't mean that the child has fully acquired the intonation system of language.

Queen (2001) studied the intonation patterns in Turkish-German bilingual children and the study discussed that the bilingual speakers use two distinct rises in both Turkish and German. The results showed that one rise resembles a characteristic German rise, while the other resembles a characteristic Turkish rise. These rising patterns found were non-normative for both Turkish and German. This fusion is proposed to account for the two-way influence between the two languages.

Cruz- Ferreira (2006) studied the intonation patterns in Portuguese- Swedish bilingual children, and reported that the canonical babbling of children sounded like Portuguese or Swedish depending on the language of interlocutors. This explained that the children follow intonation in a language- appropriate way, even though they have not achieved full mastery.

Kainada and Lengeris (2015) studied the acquisition of English intonation by native Greek speakers. They examined the production of English intonation by Greek speakers in polar questions and their pitch range. The results showed that the Greek speakers used their L1 intonation in English polar questions.

Intonation is important for a listener to know whether a sentence is a question, statement or a command. Intonation can reflect the information structure of an utterance, highlighting constituents of importance. The grammatical function of intonation is that, it helps to know whether the sentence is a question or a statement by giving information on terminal patterns such as terminal rising and terminal falling (Hargrove & Mc Garr 1994). The information carried by Fo in intonation could improve automatic speech recognition and intonation also plays an important role in intelligibility (Pierrehumbert, 1981).

The intonation systems of languages can differ along four dimensions. Those are the boundary tones, pitch accents, phonetic implementation, and their functionality (how they are used to mark question or statement) (Ladd, 1996).

Banish (2013) conducted a study on intonation patterns of sentences in Malayalam. The sentences were analyzed both in perceptual level and acoustic level. It was reported that in sentence level analysis of intonation, pitch level and terminal pitch can form different intonation patterns for different types of sentences. He reported that the intonation patterns were different for declarative, Yes/ No type of interrogative sentences, Imperative, question word interrogatives.

Intonation is one parameter of suprasegmentals that gives information on the production aspects of emotions. The intonation in a sentence varies with different emotional states.

Mathew and Bhat (2010) have done a study on emotional prosody in Malayalam and Hindi. They reported that there are differences and similarities in the FO patterns across different emotions. This can indicate that the speakers of the two languages express emotions differently. It was also noted that female participants had more loci of stress than the males which was observed for both the languages. It also concluded that there are no gender differences in the production of emotions in Malayalam and Hindi.

Pattnaik and Dash (2012) conducted a study on prosody analysis. Different types of utterances were chosen which depicted different emotions like anger, love, sad, neutral and the result showed that differences were found in fundamental frequency, maximum and minimum pitch, jitter, shimmer, durations of utterances

with different emotions and also speech associated with love and sad emotions are characterized by longer utterance duration, and higher pitch.

Most of the languages have 4 types of sentences and they are declaratives, interrogatives, exclamatory and imperatives.The intonation helps for a listener to understand a sentence as a question or a statement or a clause.

Studies have explained the various patterns of intonation in different languages, differences in intonation across the speakers of different language and different emotions. Very few researches have been done on intonation aspects of bilingual speakers when second language is learnt in later adolescent or adulthood. The present study has aimed to look into the intonation patterns of non native Arabic speakers by doing a comparison with native speakers.

Need of the study

India is a multilingual country which has around 880 languages. Most Indian language users are either bilinguals or multilinguals. It is reported that about 255 million and 87.5 million of the population are bilingual and multilingual respectively.Many languages are distinguished mainly based on the suprasegmental aspects where intonation has a key role. It is important to know how a person might depict the intonation of second language when it is learnt simultaneously or later in life. Very few studies have been done on the aspects of intonation in sequential bilinguals in India. It is also essential to know how intonation of non-native speakers of a particular language differs from its native speaker. Hence there is a need for the study to compare the intonation of Malayalam speakers who are using Kannada as their needed language with the native Arabic speakers.

Aim of the study

The aim of the study was to compare the intonation patterns between native Arabic speakers and Malayalam-Arabic speakers with the following objectives.

1. To perceptually evaluate the intonation between native and non native Arabic speakers.
2. To compare the acoustical parameters across the sentences between the native and non-native Arabic speakers.

III. METHODOLOGY

Participants:

Forty participants who were further divided as shown in the table below participated in the present study.

Groups:

Groups	Population	Number of Participants
Group 1	Native Speakers (Females)	10
Group 2	Native Speakers (Males)	10
Group 3	Native Speakers (Females)	10
Group 4	Native Speakers (Males)	10

Table 3.1: Showing the distribution of subjects participating in present study.

Inclusion Criteria:

- Group1 and 2: Subjects who are native Arabic speakers.
- Group 3 and 4: Subjects who are native Malayalam speakers with the 2 to 6 years of exposure to Arabic language.
- Participants of age range from 18 to 30 years.

Exclusion criteria:

- Subjects with voice abnormalities
- Subjects with speech and Language disorders.
- Subjects with hearing loss.

Stimuli:

For the study, 4 types of Arabic sentences were selected. The sentences were taken from an Arabic grammar book. The selected types of sentences are Exclamatory, Interrogative, Imperative and Declarative.

Instrumentation:

Acoustical analysis was done with PRAAT software (version 5.4.06) which was developed by Boersma and Weenink (2015) of the University of Amsterdam, Netherlands. The microphone used was SHURE PGA-LC Cardioid/Dynamic vocal microphone.

Procedure:
The recording was done in a sound treated room. The participants were seated on a comfortable chair and the microphone was placed at a constant distance of 10 cm away from the mouth. The participants were visually presented with the sentences written on cards one by one and instructed to say the sentences. Three recordings of each sentence were made. The second trial was taken for the test.

ANALYSIS
Perceptual analysis:
The recorded sentences were given to two speech and language pathologists for the perceptual analysis. They were instructed to make a forced four- choice and were asked to classify the sentences heard into the four chosen sentence types.
Acoustic analysis:
Maximum and minimum pitch values of each sentence were noted to find the range. Pitch value of whole sentence was noted. The jitter value of each of the sentence. The mean was taken to check the pitch perturbation throughout the sentence. The pitch pattern of each sentence was subjectively analyzed.
Statistical analysis:
The values of PRAAT were subjected to statistical analysis using SPSS software and t-test was used to find the differences between native and non native participants among 4 types of sentences.

IV. RESULTS AND DISCUSSION

This study aims to compare the intonation patterns between native Arabic speakers and bilingual Malayalam-Arabic speakers among 4 types of sentences. The study was conducted in forty participants of age range 18-30 years, who were divided into native and non-native speakers of Arabic. The study included both perceptual analysis and acoustical analysis.

Perceptual analysis:

Native Females				
	Exclamatory	**Interrogative**	**Imperative**	**Declarative**
Exclamatory	100%			
Interrogative		100%		
Imperative			100%	
Declarative				100%
Native Males				
Exclamatory	80%			20%
Interrogative		100%		
Imperative			70%	30%
Declarative				100%

Table 4.1 : Showing the percentage values for perceptual evaluation of native speakers

Non Native Females				
	Exclamatory	**Interrogative**	**Imperative**	**Declarative**
Exclamatory	50%			
Interrogative		100%		
Imperative			100%	
Declarative				100%
Non Native Males				
Exclamatory	40%			60%
Interrogative		100%		
Imperative			60%	40%
Declarative				100%

Table 4.2 : Showing the percentage values for perceptual evaluation of non native speakers

The Table 4.1 and Table 4.2 show the results of perceptual judgement of speech samples including native and non native participants respectively. Table 4.1 shows that the all speech samples of native female speakers were judged to depict the respective types of sentences. The speech samples of native male speakers were judged accurately 70% of the intended types of sentences. 20% of the exclamatory sentences were judged as declaratives and 30% of the samples of imperative sentences were judged as declaratives.

Table 4.2 shows that the recorded samples of non native female speakers were judged accurately 50% as exclamatory sentence. Out of 4 types of sentences, interrogative and declarative sentences were judged 100% accurately as intended types and 20% of the imperative sentences judged as declarative sentences.

Acoustical evaluation results:

The acoustical analysis included mean pitch, pitch range and jitter of each sentence. The mean scores of each group were considered and comparison was made. The data was statistically analyzed and 't' test was administered to find the significance differences between the groups. $p<0.05$ is considered to be significant.

Mean Pitch

Gender	Parameters	Group	N	Mean	Standard Deviation	't' test		
						't'	P	Significance
Female	Declarative	Native	10	250.900	26.396	.73	.477	NS
		Non native		244.000	14.353			
	Exclamatory	Native	10	287.900	30.395	.74	.469	NS
		Non native		256.700	28.091			
	Imperative	Native	10	294.400	20.860	2.38	.028	Sig
		Non native		289.200	27.333			
	Interrogative	Native	10	272.700	42.306	1.07	.298	NS
		Non native		261.300	25.885			
Male	Declarative	Native	10	142.200	10.591	.48	.638	NS
		Non native		147.100	18.064			
	Exclamatory	Native	10	164.100	17.629	1.80	.089	NS
		Non native		156.700	12.867			
	Imperative	Native	10	158.100	15.989	.73	.477	NS
		Non native		173.700	22.261			
	Interrogative	Native	10	158.700	23.185	.55	.588	NS
		Non native		153.100	22.253			

Table 4.3 : Showing mean pitch of native participants and non native participants for 4 types of sentences

The above table shows the statistical values for the mean pitch of each sentence in native and non native speakers. The mean values for all 4 types of sentences in female group were high for native participants, where as high mean value was obtained for exclamatory and interrogative sentences in native male participants. The 't' test showed no significant difference between native and non native speakers except for imperative sentence in females (p=0.028).

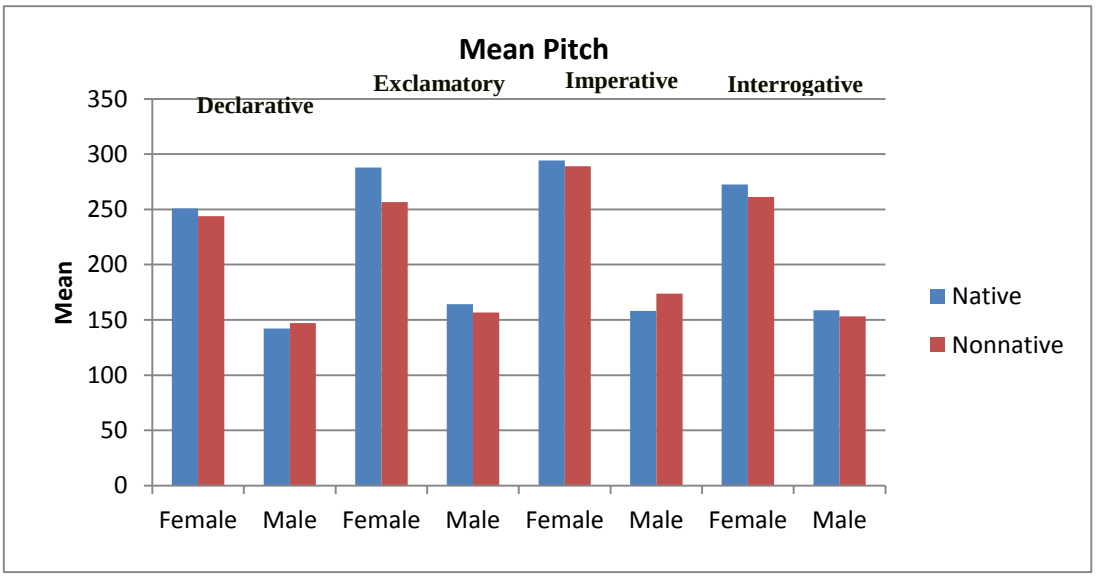

Figure 4.1: Showing the mean scores of mean pitch among 4 types of sentences for native and non native speakers.

The figure shows that the mean pitch values were less for all 4 types of sentences in non native females. The mean scores for declarative and imperative sentences were more for non native males where the scores were less in exclamatory and interrogatives.

Pitch Range

Gender	Parameters	Group	N	Mean	Standard Deviation	't' test		
						't'	P	Significance
Female	Declarative	Native	10	138.600	31.433	.98	.339	NS
		Non native		132.600	30.495			
	Exclamatory	Native	10	207.800	49.584	.98	.340	NS
		Non native		154.500	68.198			
	Imperative	Native	10	110.000	22.306	2.00	.061	NS
		Non native		107.400	29.417			
	Interrogative	Native	10	147.200	44.949	.07	.948	NS
		Non native		146.700	44.922			
Male	Declarative	Native	10	80.400	28.395	1.06	.302	NS
		Non native		69.800	19.043			
	Exclamatory	Native	10	111.900	55.571	1.62	.122	NS
		Non native		110.600	26.613			
	Imperative	Native	10	79.900	29.554	.17	.864	NS
		Non native		62.600	18.481			
	Interrogative	Native	10	101.600	34.186	2.25	.037	Sig
		Non native		74.900	17.148			

Table 4.4 : Showing the pitch range of native and non native participants for 4 types of sentences

The table 4.4 shows the statistical values for the range of pitch in native and non native speakers. There is difference in the mean values between the groups. Mean value of pitch range is reduced in non native speakers. The range of pitch was high for exclamatory sentences among all the groups compared to other types of sentences. The 't' test showed no significant difference between native and non native speakers except for interrogative sentence in males (p=0.037).

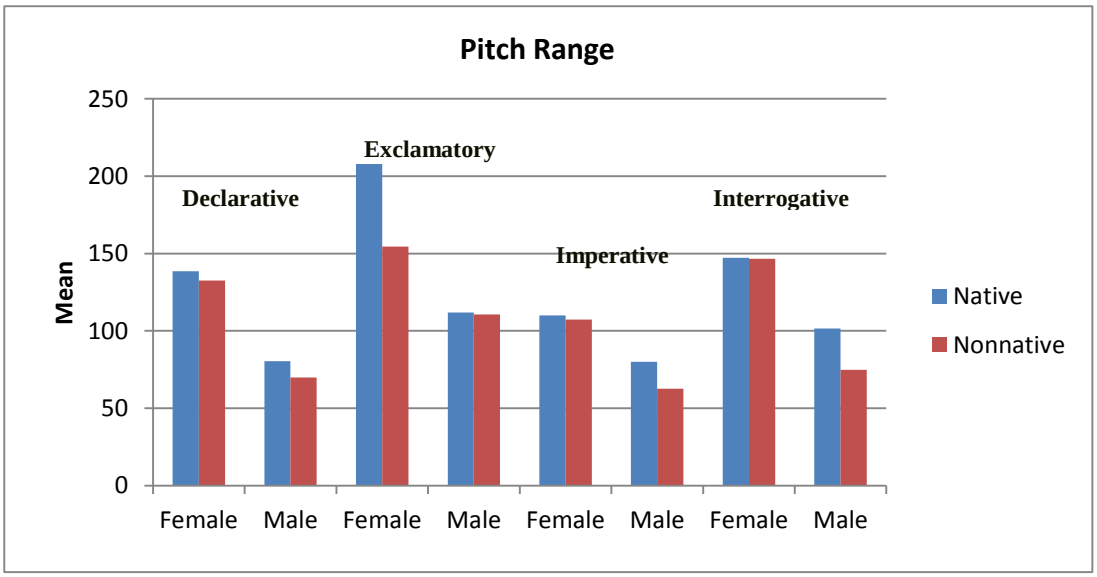

Figure 4.2: Showing the mean scores of pitch range among 4 types of sentences for native and non native speakers.

The figure indicates that the pitch range was reduced in non native speakers compared to the native Arabic speakers for all types of sentences. The mean pitch range was high for exclamatory sentences in all the groups compared other types of sentences.

Jitter

Gender	Parameters	Group	N	Mean	Standard Deviation	't' test		
						't'	P	Significance
Female	Declarative	Native	10	1.675	.205	1.56	.137	NS
		Non native		1.886	.376			
	Exclamatory	Native	10	2.345	.492	1.21	.242	NS
		Non native		2.898				
	Imperative	Native	10	1.992	.351	2.62	.017	Sig
		Non native		2.419	.223			
	Interrogative	Native	10	2.141	.389	1.84	.082	NS
		Non native		2.310	.264			
Male	Declarative	Native	10	1.790	.191	3.25	.004	HS
		Non native		1.680	.215			
	Exclamatory	Native	10	12.203	.371	.77	.448	NS
		Non native		2.513	.382			
	Imperative	Native	10	2.290	.307	1.14	.271	NS
		Non native		2.410	.381			
	Interrogative	Native	10	2.416	.315	.17	.863	NS
		Non native		3.391	.324			

Table 4.5 : Showing the mean values of jittar among 4 types of sentences for native and non native participants

The above table shows the statistical values for the jitter in native and non native speakers. The mean values of jitter are high for non native speakers than native Arabic speakers. The 't' test showed no significant difference sentences among native and non native speakers except for imperative sentence in females (p=0.017) and declarative sentences in males (0.004).

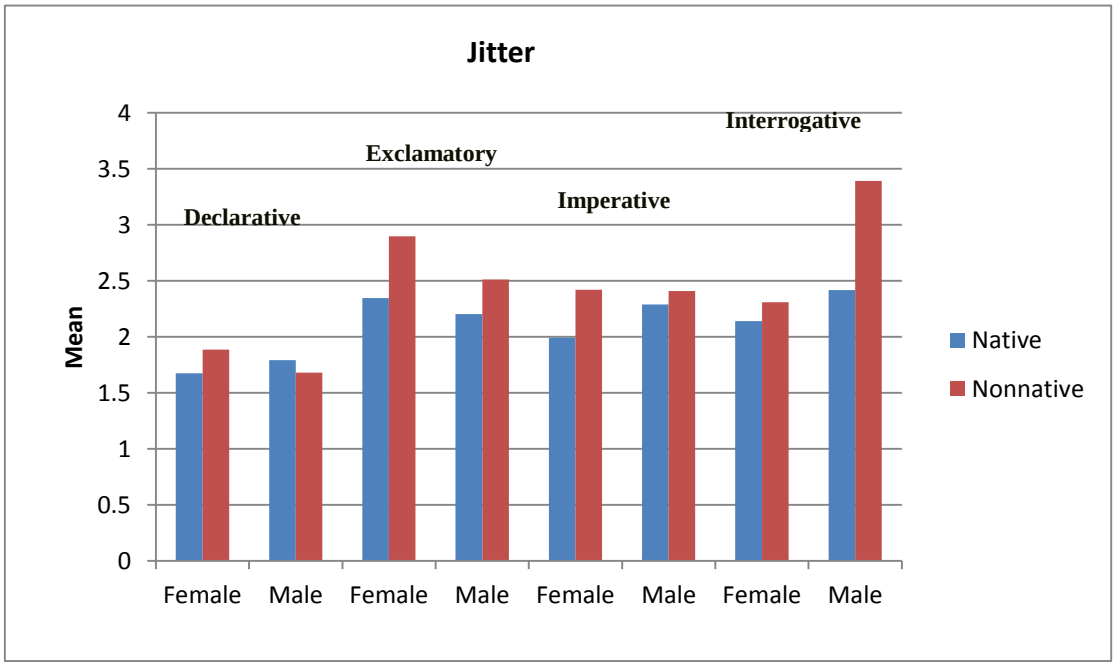

Figure 4.3: Showing the mean scores of jitter among 4 types of sentences for native and non- native speakers

The figure 4.3 shows that the jitter scores of non native speakers was more compare to native speakers. This result was varied for declarative and interrogative sentences in males. The mean value was high for exclamatory sentences in all the groups.

The pitch patterns were also noted for each sentence among the groups.

The figure 4.4 and 4.5 show the pitch patterns for exclamatory, interrogative, imperative and declarative sentences respectively.

	Native Female Speaker 1	**Non native Female Speaker 1**
Exclamatory		
Interrogative		
Imperative		
Declarative		

Figure 4.4: Showing the pitch patterns of native and non native female speakers for 4 types of sentences.

	Native Male Speaker 1	**Non native Male Speaker 1**
Exclamatory		
Interrogative		
Imperative		
Declarative		

Figure 4.5: Showing the pitch patterns of native and non native male speakers for 4 types of sentences.

Figure 4.4 and figure 4.5 show the pitch patterns for all 4 types sentences among native and non native speakers. Exclamatory sentences show terminal rising pattern for all native speakers and terminal falling patterns for all non native speakers. The interrogative sentence shows rising pattern for all the speakers. Imperative and declarative sentences have showed a common terminal falling pitch pattern.

V. DISCUSSION

The present study analysed the samples both perceptually and acoustically. Perceptual analysis indicated that the non native speakers could not depict the types of sentences as the native speakers except for declaratives and interrogative. The 80% of female non native speakers were able to match the native speakers for exclamatory sentence and 70% of them were able to match the imperative sentene accurately. The male group did not show the same result. The male native speakers were not analysed to be 100% accurate for exclamatory and imperative. All the samples were judged as accurate for interrogatives.

The pitch range was found to be reduced for non native speakers in all 4 types of sentences.The't' test showed significance only for imperative sentence in females. The mean pitch value of each sentences showed greater for native female speakers than non native female speakers. The same result was not seen for male participants. The mean values were high for interrogative and exclamatory sentences compared to imperative and declarative sentences in both native and non native participants. The statistical analysis showed no significant difference between the groups except for imperative sentence in females.

The jitter value of each sentence was considered and there was greater jitter value for non native female speakers for all 4 types of sentences. This was thought to be as a result of exaggeration of intonation in non native speakers in order to match the native pattern. The't' test showed significant difference for imperatives in females and declaratives in males. There is no study which has considered jitter in differentiating the types of sentences.

The pitch patterns for exclamatory and interrogative sentences were rising.

The present study results showed falling terminal pitch patterns for 6 of the non native speakers for exclamatory sentences in the present study. All the interrogative samples showed rising pattern.

The overall result indicated the reduced mean pitch, reduced pitch range and difference in pitch patterns in non native speakers compared to native Arabic speakers.

VI. SUMMARY AND CONCLUSION

Intonation is one of the important suprasegmental features. Intonation plays an important role in communication. It helps to understand the sentence whether it is a question or a statement. A linguistic message is complete only when intonation is added to it. It also helps in understanding speaker's emotions. Every language has its own intonation system and intonation varies across the languages. It is also important to know the aspects of intonation variation of a particular language when it spoken by the non native speakers.

The current study compared the intonation of Kannada between its native speakers and Malayalam speakers who have learnt Arabic as their social need. Fourty participants were considered for the study who were further divided into native and non native speakers. The PRAAT software was used and 4 types of Arabic sentences were chosen for the study. The perceptual analysis stated that the non-native participants were not able to match the accurate intonation of native speakers for exclamatory and interrogative sentences. The results showed reduced range of pitch, mean pitch for non native females. Also the jitter values were greater for the non native speakers which indicated that the pitch perturbation within the sentence was more in non native speakers though the range was limited.

In present study, differences were found between native and non native speakers for mean values and pitch patterns. The perceptual analysis showed a greater difference between native and non native Arabic speakers. These changes indicate that non native speakers may not be able to depict the required intonation of second language when it is learnt later in life and also possibilities of transfer of intonation from first language.

This could be a useful finding in the field of speech and language where knowledge about the aspects of intonation is important. This study gives an understanding for a Speech Language Pathologist on the aspects intonation and helps as an aid in assessing bilingual population with communication disorders.

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