Comparison on the Frequency of Occurrence Phonemes in Calicut Dialects

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Abstract— Malayalam is a Dravidian language primarily spoken in the southwest of India.The purpose of the present study was to obtain the frequency of occurrence of various phonemes in Calicut, Quilandi, Coastal dialects using Malayalam conversation samples. Sixty people participated in this study. Each participants were classified in to four groups (Group I-20-30, Group II-31-40, Group III-41-50, Group IV-51-60) based on those from Calicut dialect, Quilandi dialect and Costal dialect. Each group was comprised of 10 males and 10 females with an age range of 20 to 60 participated in the study. The samples obtained were transcribed using IPA transcription. Further analysis was done manually. The results showed that the short central vowel /a/ was the most occurring vowel in Quilandi, dialects, Calicut dialect, coastal dialect. Comparing to the each dialect Quilandi was higher significant productions of vowel because of the number of participants is higher in the Quilandi dialect. In Quilandi dialect the most occurring consonant was dental nasal/n̪/, In Calicut and Coastal dialect voiceless velar stop /k/ was more occurring consonants. Comparing to the each dialect Quilandi was higher significant productions of consonants.To conclude, the current study helps us to understand the most frequency of occurrence of phoneme in each dialects (Calicut, Quilandi, Coastal) in Calicut. There is a significant difference between the all the three dialects. The results obtained will be made available to communication professionals to develop and update several test materials in Malayalam for evaluation and speech and language therapy purpose.

Keywords: Dravidian Language, Malayalam, Vowels, Consonants

I. INTRODUCTION

India is a country with various languages and these language have totally differently completely phonemes system and there area unit different dialects beneath every languages. The information base of various languages includes a kind of speech sound frequency which can helps to review a language better. Frequency of incidence of phonemes in every non-standard speech vary supported its phonologic system. Malayalam is one in all the normal languages among the four Dravidian languages. South Dravidian is a language spoken in southwest of Indian state of Kerala and Lakshadweep island. South Dravidian is spoken by 4% of the Indian populations. It belongs to the southern cluster of Dravidian languages and is taken into account because the baby within the Dravidian family. South Dravidian is that the language with vocabulary borrowed from different languages like Sanskritic language, Tamil, etc. Arrival of alternative European languages created inroad in to South Dravidian and more into its enrichment. South Dravidian additionally absorbed many words and idioms from English, Portuguese

and Dutch. South Dravidian originally contains thirty seven consonants and fourteen vowels. Malayalam has fine grammatical tradition. It's associate enriched language with advanced vary of regional, social and stylistic variations.

The dialects area unit variations of single language, they differ in terms of vocabulary, grammar, linguistics and pronunciation. The frequency of phonemes will vary from languages to language and dialect to dialect. Idiom could be a kind of language that signals wherever someone comes from. The notion completely different taken geographically (regional dialects). as an example, 'nthu', 'enthutta','enthootu', 'nthutta', 'nthootu', 'enthonnu' and 'nthonnu' area unit interpreted Thrissur dialects for one South Dravidian word 'enthu' with a which means 'what' by [1], however it additionally has some applications in regard to person's social background (class dialect). At the University of California by[2] a study supported analyzing the ratio of incidence of phonemes in an exceedingly sample of General-American English. Uses data (65,122 phonemes) transcribed from six lectures given to foreign students. The other speech sound frequency studies use information aside from casual or informal speech. it's probably that the word selection associated pronunciation were suffering from the actual fact that the speech was delivered in an exceedingly 'lecture' vogue instead of 'casual' vogue and was self- addressed to an audience composed of non-native speakers of English. The study shows that within the case of the phonemes that occur comparatively most often, embrace /a/, /I/, /r/ /e/, /n/, /t/, /r/, /s/, /1/, /d/, /d/. The standard error deviations, on the total area unit important; however within the case of the opposite phonemes, all below 3.00%, the quality error deviations tend to be decreased.

In kannada recent study was conducted by [3]study was to get the frequency of incidence of varied phonemes in South Dravidian exploitation speech communication samples, found that informal and spoken South Dravidian , the foremost often occurring phoneme was vowel /a/ followed by /n/,/ɪ/,/e/,/r/,/a:/,/d/,/ɪ/,/u/,/g/ and /k/ phonemes /h/,/s/,/p/,/tʃ/,/dʒ/,/ʃ/ occurred less often and vowels established 44.3% and consonants 55.3% of the informal information in South Dravidian by[4] studied on the statical options of teach parameters such area unit length and fundamental pitch of a collection of vowel within the Tamil language. The result showed that experiments that the speech sound /i/ has the most range occurrences for mono syllabic words and /a/ has the second most occurrences within the mono syllabic words within the Tamil. It's conjointly noted that the vowels /o/ and /e/ have the smallest amount occurrences. In Hindi studied by[5] on phone and morphemic frequency in Hindi. Supported a written supply of fabric of material that vowel were pre dominant than consonants in Hindi. Most frequent word was found to be /hai/, most linguistic unit was/ke/, most frequent speech sound was /a/,

most frequent linguistic unit was /ke/.) A studied conducted by [6]telgu syllables and located that consonants (51.21%) were three dominant in spoken information than vowels (44.98%). Open vowel were higher in frequency.

occurrence of phonemes in Calicut and Ernakulum dialects of South Dravidian done by [7]studied informal samples of Calicut and Ernakulum dialects of South Dravidian and analysis show that /a/ was the foremost often occurring vowel and /k/ was most often occurring consonants in each dialects. In Calicut dialects, different most often occurring vowel were /ɪ, ə,aː,e/ and consonants were/n,t,ḷ/ . In Ernakulum non-standard speech /a,ɪ,ə,aː/ most often occurring vowel and consonants were /k,n,p,t,ḷ,m/ .A study conducted by[8] they found that in Calicut dialect /a/ was the foremost often occurring vowel and /k/ was most often occurring consonants. the opposite most often occurring vowel were /ɪ,ə,aː,e/ and consonants were /ṉ,ṯ,t,ḷ/.Overall vowel constituted 42.54% and consonants 57.26% of conversational data.

Therefore the present study is aimed to compare the frequency of occurrence of phonemes in conversational speech samples of Calicut dialects, Quilandi dialects and coastal dialects.

II. METHOD

A. *Participants: Fluent adult native speakers of Malayalam.*

Total of 60 participants were selected for the study.
A written consent as provided .Ethical Guidelines
for Bio-Behavioural Research,AIISH (2009) was followed for the study. They was administered with LEAP-Q (Language Expertise and Proficiency Questionnaire) developed by [9] Participants were selected within the age range of 20 to 60 years with at least 10-12 years of required education in Malayalam medium of instruction.Participants who have not undergone any kind any neurologic deficit, psychological abnormality and articulation abnormality was avoided from the study. Twenty participants are classified in to 4 teams (Group I-20-30,Group II-31-40, cluster III-41-50,Group IV-51-60) supported those from Calicut dialect, Quilandi dialect and Coastal dialect .Every cluster was comprised of 10 males and 10 females. As the precaution for Covid 19 the researcher would ensure to use mask and maintain a one-meter distance from the participants while doing the assessment

B. *Instrumentation:For recording the conversation samples*

Voice recorder SONYMz322 was used.
Procedure: The data was collected through conversation in controlled natural environments for about 15 to 20 minutes of duration. The investigator can make a case for the subsequent statement to the participants. ''Ask them to inform their name and age''and initiate spoken communication by asking "Tell me however you're feeling this year once facing a corona pandemic like academic problems, employment problems, health problems etc".The digital recorder was kept at equidistance from the speaker whereas conducting the check. Their name, age and whole the testing procedure was recording . The complete testing procedure was concisely explained and a consent kind was obtained from every participant .The participants was schooled to avoid words from different languages and to talk naturally solely in Malayalam and that they was restricted from normally unremarkably used loan English words like (Hospital, food , etc.).

C. *Data Analysis:*

The collected data samples was transcribed exploitation IPA (International Phonetic Alphabet, Malayalam 2005), The transcribed information was analyzed manually to count the frequency of incidence of vowels and consonants.

D. *Inter Judge and Intra Judge Reliability:*

100% of the recorded samples from conversation and therefore the reading passage are subjected to inter and intra subject reliability. Cronbach's alpha to economical analysis are accustomed verify the inter and intra judge responsibility. smart responsibility in step with in keeping with konting et.al (2009) is 0.81-0.90. 3 graduate speech language pathologists are designated for the analysis of inter judge responsibility.

III. RESULTS AND DISCUSSION

The descriptive statistics of Mean, Median and Standard Deviation was computed for all parameters. The data was subjected to Shapiro Wilks test for normality. The results revealed that the data is significantly deviating from normal distribution (i.e., p<0.05). Therefore, a non-parametric kruskal-wallis test to see the significantly difference across dialects. If there is a significant difference, Mann Whitney U test was carried out to determine the significant difference be carried out for pairwise significant difference between age groups for all the vowels and consonants all the three dialects for Malayalam. . The statistical significance values are compared with 0.05 or 0.01 level of significance. The whole statistical analysis was done using SPSS version 20.

A. *Descriptive statistics of 3 dialects in Malayalam conversational task*

Vowel	Calicut			
	n	Mean	Median	SD
a	20	38.95	26.00	33.73
aː	13	16.08	8.00	17.51
ə	16	9.75	6.00	7.52
I	19	16.26	11.00	14.22
iː	6	5.00	5.50	3.74
u	20	11.15	7.50	8.47
uː	4	2.25	2.00	1.26
e	19	6.47	6.00	4.81
eː	4	4.00	3.50	2.94
o	20	6.65	6.00	3.91
oː	9	6.56	5.00	6.37
əɪ	1	1.00	1.00	-
əʊ	-	-	-	-

Note. n=Number, SD= Standard Deviation
Table 1: Descriptive statistics of Mean, Median and Standard Deviation of vowels in Calicut dialect in Malayalam using conversation task

Vowel	Quilandi			
	n	Mean	Median	SD
a	20	48.75	50.50	23.85
aː	20	20.05	20.00	10.67

ə	20	13.45	14.50	8.88
I	20	32.75	27.00	17.49
i:	16	2.56	2.00	1.79
u	20	23.80	22.00	13.05
u:	10	1.80	2.00	0.79
e	20	12.05	12.50	5.97
e:	20	4.25	3.50	3.09
o	19	6.58	6.00	3.95
o:	20	10.55	9.00	7.49
əɪ	7	1.43	1.00	0.79
əʊ	2	2.00	2.00	1.41

Note. n=Number, SD= Standard Deviation

Table 2: Descriptive statistics of Mean, Median and Standard Deviation of vowels in Quilandi dialect in Malayalam using conversation task

Vowel	Coastal			
	n	Mean	Median	SD
a	20	24.95	27.50	13.28
a:	10	3.60	2.50	2.91
ə	16	6.63	6.50	4.50
I	18	8.78	7.50	6.86
i:	3	1.33	1.00	0.58
u	13	9.62	10.00	5.08
u:	2	1.50	1.50	0.71
e	13	3.54	2.00	3.07
e:	2	3.00	3.00	2.83
o	15	5.47	5.00	2.80
o:	7	2.14	2.00	1.46
əɪ	3	1.67	2.00	0.58
əʊ	-	-	-	-

Note. n=Number, SD= Standard Deviation

Table 3: Descriptive statistics of Mean, Median and Standard Deviation of vowels in Coastal dialect in Malayalam using conversation tas
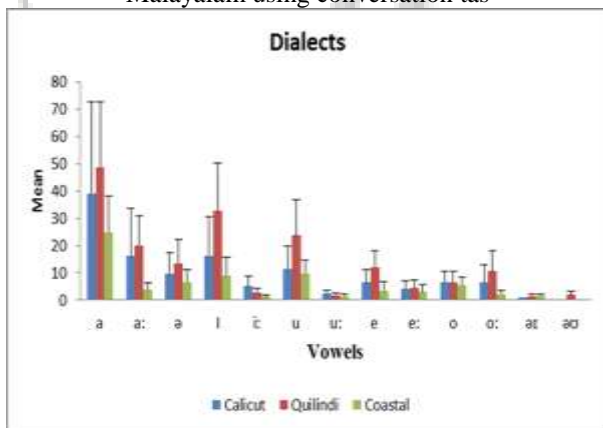

Fig. 1: Descriptive statistics of Mean, Median and Standard Deviation of vowels in each dialect in Malayalam using conversation task.

The following vowels (/a/,/a:/,/ə/,/i/./i:/,/u/,/u:/,/e/,/e:/,/o/./o:/,and Diphthongs /əɪ/,/əʊ/) were obtained from the three dialects of Malayalam taken for the present study which is Calicut dialect, Quilandi dialect and Coastal dialect. Table 1,2,3 and Fig1 represents Descriptive statistics of Mean, Median and Standard Deviation of vowels in each dialect in Malayalam using conversation task. Short vowel /a/ was the highest in Quilandi

dialect with M=48.75 followed by its long vowel /a:/ with M=20.05, followed by short vowel /ə/ M=13.45,and by short vowel /i/ M=32.75. The long vowel /i:/ with M=5.00 was found to be high in Calicut dialect. Short vowel /u/ M=23.80 was also highest in the Quilandi dialect followed by short vowel /e/ M=12.05 vowel /e:/ with M=4.42.vowel /u:/ M=2.25 highest in the Calicut dialect. Vowel /o/ and its long vowel /o:/was the highest in Quilandi dialect with M= 6.58 and M=10.55. Diphthong /əɪ/ was the highest in coastal dialect with M=1.67 and diphthong /əʊ/ was observed only in Quilandi dialect with M=2.00.

Fig.1 and Table 1 the Quilandi dialect showed the highest mean in most of the vowels (/a/ M=48.75) followed by Calicut dialect (/a/ M=38.95) and the Coastal dialect (/a/ M= 24.95). This shows that there is high production of vowels in the Quilandi dialect compared to the Calicut and coastal dialect; it could be because the numbers of participants producing the vowels were high compared to the other dialects. Moreover, it is found that vowel /a/ productions are high in Quilandi dialect. This is correlated with the study reported by [10] However, Table 2 Calicut dialect had the highest occurring vowel /a/, this is in support with the study done by [11] In Table 3 coastal dialect had highest occurring vowel was /a/ this is in support with the study conducted by [12] in American Spanish. As observed from Table 1& 2 the next most occurring vowel was /i/ in Calicut and Quilandi dialects of Malayalam, this is in consonance with the study by [13] and Table 3 vowel /u/ for coastal dialect. These findings are supported by a study in Japanese language done by [14]

Kruskal-Wallis Test		
vowels	χ^2 (2)	p-value
/a/	8.62	0.013*
/a:/	14.01	0.001**
/ə/	5.99	0.050*
/i/	23.63	0.000**
/i:/	3.34	0.188
/u/	15.39	0.000**
/u:/	0.72	0.698
/e/	20.09	0.000**
/e:/	0.25	0.883
/o/	0.75	0.689
/o:/	11.81	0.003**
/əɪ/	1.24	0.538
/əʊ/	-	-

Note. * Indicates significant at p< 0.05
** Indicates significant at p<0.01

Table 4 :Comparison of vowels across each dialect of Malayalam using conversation task

Table 4 indicates that there are some significant differences noticed in vowels, such as /a/,/a:/,/ə/,/i/,/u/,/e/,/o:/. To examine the significant difference in the occurrence of vowels across the three dialects, non-parametric kruskal-wallis test was carried out.

The result revealed that short central vowel /a/ [χ2(2) = 8.62 p=0.013] and long central vowel /a: / [χ2(2) =14.01, p=0.001], showed the highest significant difference in Quilandi dialect ,Calicut and coastal dialects. Similarly for short central vowel /ə/ [χ2(2)= 5.99, p=0.050] showed the highest significant difference in Quilandi dialect compared to

the other Malayalam dialects. Short front vowel /i/ [□2(2) =23.63, p=0.000] when compared to the Calicut and coastal dialects, the Quilandi dialect exhibited the greatest significant difference. Similarly, when comparing Calicut and coastal dialects, the short back vowel/u/ [□2(2)=15.39,p=0.000] exhibited the most significant difference. Short front vowel /e/ [□2 (2) =20.09, p=0.000] and long back vowel /o:/ [□2 (2) = 11.81,p=0.003] showed highest significant difference in Quilandi dialect compare to other Malayalam dialects .

However, Kruskal-wallis test was not significant for vowels /i:/, /u:/ /e:/ and /o/ and Diphthong /əɪ/ across the three dialects.

Mann-Whitney U test was performed to examine the significant difference across each pair of dialects as shown in Table 5.

Mann-Whitney U						
vowels	Calicut vs Quilindi		Calicut vs Coastal		Quilindi vs Coastal	
	|Z|	p-value	|Z|	p-value	|Z|	p-value
a	1.543	0.123	0.529	0.597	3.266	0.001**
a:	1.291	0.197	1.566	0.117	4.076	0.000**
ə	1.133	0.257	1.119	0.263	2.490	0.013*
I	3.361	0.001**	1.919	0.055	4.492	0.000**
u	3.292	0.001**	0.148	0.883	3.394	0.001**
e	3.017	0.003**	2.112	0.035*	4.073	0.000**
o:	1.608	0.108	1.416	0.157	3.416	0.001**

Table 5: Mann –Whitney U test: Dialect comparison for vowels.

As seen in Table 5 for vowels, based on a pair-wise comparison of the Calicut vs. Quilandi dialects vowels. The Quilandi dialect produced significantly more ,short front vowels /i/ with M=32.75;SD=17.49 compare to the Calicut dialect with M=16.26;SD=14.22,short back vowels /u/with M=23.80;SD=13.05 high significant in Quilandi dialect compared to the Calicut dialect with M=14.22;SD= 8.47,and short front vowels with /e/ M=12.05;SD=5.97 than the Calicut dialect with M=6.47;SD=4.81.

A pair-wise comparison of short front vowel /e/ with M=6.47; SD=4.81 high in Calicut dialect compared to the coastal dialect with M=3.54;SD=3.07 revealed significant higher production in the Calicut dialect.it is because of vowel production are higher in Calicut dialect compared to the other dialect. The vowel/e/was the most occurring vowel in Telugu in a study carried out by[15] Similarly, for Quilandi vs. Coastal dialect .Short central vowel /a/M= 48.50;SD=23.85 high significant in Quilandi dialect compared to the coastal dialect with M= 24.95;SD=13.28, long central vowel /a:/ with M=20.05;10.67 high significant in Quilandi dialect compared to the coastal dialect with M=3.60;SD=2.91, Short central vowel /ə/ M=13.45;SD=8.88 high significant in Quilandi dialect compared to the coastal dialect with M=6.63;SD=4.50 In Quilandi dialect, short front vowel/i/ with M=32.75;SD=17.49 was high in Quilandi dialect compare to the coastal dialect with M=8.78;SD=6.86, short back vowel /u/ with M=23.80;SD=13.05 high significant in Quilandi dialect compared to the coastal dialect with M=9.62;SD=5.08.Short front vowel /e/ with M=12.05;SD=5.97 high significant in Quilandi dialect compared to the coastal dialect with M=3.54;SD=3.07 and long back vowel /o:/ with M=10.55;SD=7.49 was high significant in Quilandi dialect compared to the coastal dialect with M=2.14;SD=1.46, showed the significant higher production in Quilandi dialect compared to Calicut dialect because of the number of participants is higher in the Quilandi dialect compared to other dialects .Which is supported by a Japanese study conducted by[16] who discovered that the most frequently occurring vowels are/a/,/i/, and/o/.

A pair-wise comparison of short front vowel /e/ with M=6.47; SD=4.81 high in Calicut dialect compared to the coastal dialect with M=3.54;SD=3.07 revealed significant higher production in the Calicut dialect.it is because of vowel production are higher in Calicut dialect compared to the other dialect. The vowel/e/was the most occurring vowel in Telugu in a study carried out by[17]

Consonants	Calicut				Quilandi			
	n	Mean	Median	SD	n	Mean	Median	SD
/k/	17	17.71	11.00	16.58	20	21.70	22.00	12.06
/kɦ/	1	1.00	1.00	-	1	1.00	1.00	-
/g/	6	2.00	2.00	1.10	8	2.13	2.00	1.13
/gɦ/	1	2.00	2.00	-	2	1.00	1.00	0.00
/tʃ/	17	6.71	4.00	6.33	19	6.79	5.00	6.10
/tʃɦ/	1	1.00	1.00	-	1	1.00	1.00	-
/ɟ/	7	1.43	1.00	1.13	13	2.62	2.00	2.69
/ʈ/	19	13.37	8.00	11.44	20	18.25	17.00	10.10
/ʈɦ/	-	-	-	-	2	2.00	2.00	0.00
/ɖ/	5	1.20	1.00	0.45	8	2.38	2.00	1.41
/t/	20	14.50	8.50	14.75	20	17.75	15.00	11.37
/tʰ/	4	1.00	0.00	2.00	7	1.43	1.00	0.53
/d̪/	10	1.70	1.50	0.82	15	2.67	2.00	1.18
/d̪ɦ/	7	2.57	2.00	1.72	16	2.75	2.00	1.13
/p/	18	8.28	6.50	4.53	20	16.35	12.50	11.04
/pʰ/	7	0.86	1.00	0.90	2	1.00	1.00	0.00
/b/	12	2.67	2.00	1.61	18	3.06	2.50	2.51
/bɦ/	6	1.33	1.50	1.21	12	1.42	1.00	0.90
/ŋ/	7	5.29	2.00	6.78	17	4.94	4.00	3.65
/ɲ/	5	3.20	1.00	3.90	17	4.35	4.00	2.94

/ŋ/	16	6.06	3.00	5.45	19	11.05	12.00	6.31
/ɳ/	17	9.06	7.00	6.76	19	22.26	21.00	11.59
/m/	19	8.11	4.00	7.67	20	11.20	10.00	8.55
/j/	20	7.80	7.50	5.50	20	15.20	12.50	9.75
/ɾ/	20	6.85	4.00	5.47	20	9.90	8.50	5.57
/l/	14	8.29	6.00	6.34	20	12.65	11.50	7.57
/ʋ/	18	6.39	5.50	4.80	20	10.40	10.00	4.63
/ʃ/	5	2.80	2.00	1.10	15	2.47	2.00	2.07
/ʂ/	11	1.55	1.00	1.51	13	2.31	2.00	1.55
/s/	18	3.72	2.50	4.07	20	6.10	5.00	4.00
/h/	11	1.73	3.00	1.49	7	1.43	1.00	0.79
/ɭ/	11	5.82	5.00	4.31	16	6.25	4.00	6.52
/ɻ/	7	2.43	1.00	2.15	8	2.38	2.00	1.69
/r/	15	4.13	3.00	2.36	20	7.55	7.00	4.08
/n/	17	4.71	4.00	3.79	20	8.95	8.00	6.90
/t̪/	18	3.56	1.00	5.33	20	3.90	2.00	4.12

Note. n=Number, SD= Standard Deviation

Table 6: Descriptive statistics of Mean, Median and Standard Deviation of consonants in calicut and Quilandi dialect in Malayalam using conversation task

Consonants	Coastal			
/k/	n	Mean	Median	SD
/kɦ/	19	19.58	15.00	13.48
/g/	1	1.00	1.00	-
/gɦ/	3	1.00	1.00	0.00
/tʃ/	1	4.00	4.00	-
/tʃɦ/	12	4.33	3.00	3.39
/ɟ/	1	10.00	10.00	-
/t̪/	12	1.50	1.50	0.52
/t̪ɦ/	12	11.83	10.00	9.71
/d̪/	-	-	-	-
/t/	3	1.00	1.00	0.00
/tʰ/	18	11.89	10.00	10.20
/ḏ/	-	-	-	-
/dɦ/	2	2.50	2.50	2.12
/p/	1	1.00	1.00	-
/pʰ/	16	16.69	15.00	11.91
/b/	2	2.50	2.50	0.71
/bɦ/	7	1.29	1.00	0.49
/ŋ/	-	-	-	-

/ɲ/	3	3.67	4.00	2.52
/ŋ/	5	3.40	2.00	2.51
/ɳ/	11	3.73	3.00	2.53
/m/	18	15.11	10.50	9.32
/j/	19	14.11	11.00	9.39
/ɾ/	18	10.50	10.00	6.15
/l/	18	8.11	6.00	4.87
/ʋ/	12	5.17	4.50	4.26
/ʃ/	11	7.91	6.00	6.20
/ʂ/	11	3.36	3.00	1.57
/s/	10	3.90	2.50	3.31
/h/	11	2.73	2.00	1.62
/ɭ/	4	2.00	1.00	2.00
/ɻ/	15	10.87	12.00	7.84
/r/	4	5.25	5.00	3.69
/n/	8	3.88	3.50	1.73
/t̪/	11	4.27	3.00	3.00
	6	1.67	1.50	0.82

Note. n=Number, SD= Standard Deviation

Table 7: Descriptive statistics of Mean, Median and Standard Deviation of consonants in Coastal dialect in Malayalam using conversation task
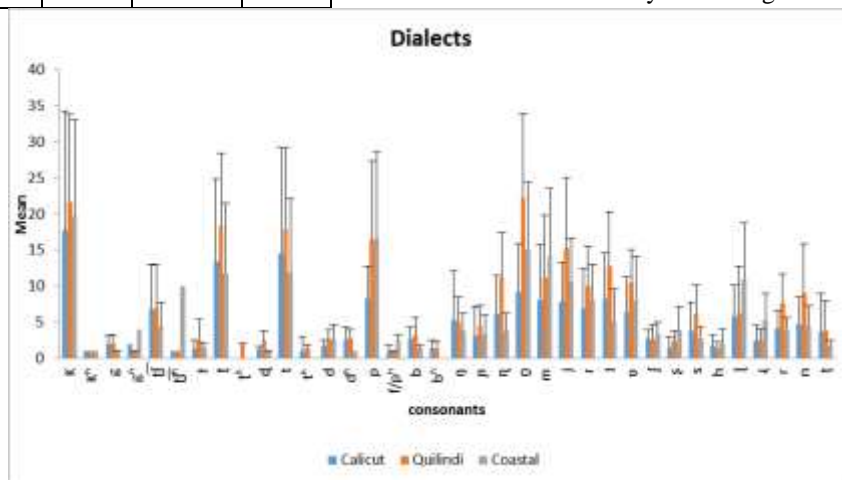

Figure 2 Descriptive statistics of Mean, Median and Standard Deviation of consonants in each dialect in Malayalam using conversation task

Table 6 & 7and Fig.2 represents the consonants such as (/k/,/kᶠ/,/g/,/gᶠ/c/,/cᶠ/,/ɟ/,/ʈ/,/ḍ/,/ʈᶠ/,/ṭ/,/ṭᶠ/,/ḍ/,/ḍᶠ/,/p/,/pᶠ/,/b/,/bᶠ/,/ŋ/,/ɲ/,/ɳ/,/n̪/,/m/,/j/,/ɾ/,/l/,/ʋ/,/ʂ/,/s/,/h/,/ɭ/, /ɻ/,/r/,/n/,/t̪/) were obtained from the three dialects of Malayalam taken for the present study, which are the Calicut dialect, the Quilandi dialect, and the Coastal dialect.

In comparison to the other dialects, Table 6 the Quilandi dialect had the highest M=21.70 of voiceless velar stop /k/,With M=1.0 the voiceless velar stop/kᶠ/ acted similarly. The Quilandi dialect has a greater voiced velar stop/g/ with M=2.13 than the Calicut and coastal dialects, as does the voiceless palatal affricate/tʃ/ with M=6.79.The voiceless retroflex stop /ʈ/ with M=18.25 and the voiceless retroflex stop /ʈᶠ/ with M=2.25 were higher in the Quilandi dialect compared to the other Malayalam dialects such as the Calicut and coastal dialects. Voiced retroflex stop /ḍ/ with M=2.38. Voiceless dental stop /ṭ/ with M=18.25 these are the consonants that are higher in the Quilandi dialect compared to the other dialects. The voiceless retroflex stop /ṭᶠ/ was observed only in the Quilandi dialect. Voiced dental stop /ḍ/ with M=2.67 was higher in Quilandi dialect compared to the other dialects, likewise the voiced dental stop /ḍᶠ/ with M=2.75 subsequently the voiceless bilabial stop /p/ with M=16.35. The voiced bilabial stop /b/with M=3.06, and a voiced bilabial stop /bᶠ/ with M=1.42. Palatal nasals/ɲ/ with M= 4.35 was higher in Quilandi dialect compared to the Calicut and coastal dialect. Retroflex nasal /ɳ/ with M=11.05 was higher in Quilandi dialect compared to the other Malayalam dialect. Dental nasal /n̪/ with M= 22.26 after that , palatal glide/j/with M= 15.20 was higher in Quilandi dialect compared to the Calicut and coastal dialect. The results supported that the study done by[18] in Telugu found that palatal glide /y/ was the most occurring vowel. The trill /ɾ/ with M=9.90 was higher in Quilandi dialect compared to the other dialects, comparably the alveolar lateral /l/ with M= 12.65, and the labiodental approximant /ʋ / with M= 10.40 was higher in Quilandi dialect compared to the other dialects. Voiceless alveolar stop /s/ with M=6.10 and the alveolar nasal /r/ with M=7.55 are higher in Quilandi dialect compared to the other dialects. The alveolar nasal /n/ with M=8.95 and voiceless alveolar stop /t/ with M=3.90. These consonants are higher in the Quilandi dialect compared with the other dialects. These results were supported by[19] concluded that the frequently occurring vowels in their study are /n/,/d/,/g/,/k/ in kannada.In Quilandi dialect the most occurring consonant was dental nasal/n̪/ (M=22.26),because the number of participants were more in Quilandi dialect compared to other dialects. This is consonance with the study [20] in Setswana language and they have reported that consonants /n̪/ occurred most frequently.

In Table7 Coastal dialect Voiced velar stop /gᶠ/with M=4.00.Voiceless palatal stop /tʃᶠ/ M= 10.00. Labiodental fricative /p/ with M=2.50. Bilabial nasal /m/ with M=14.11.Palatal fricative /ʃ/ with M=3.36, followed by alveolar fricative /ʂ/ with M= 3.90. Glottal fricative /h/ with M=2.00, followed by retroflex lateral /ɭ/ with M=10.87, and retroflex approximant /ɻ/ with M=5.25 was the highest consonants in coastal dialect compared to the other Malayalam dialect. Compared to the other dialect the most occurring consonant was voiceless velar stop /k/ are in coastal dialect.

This is correlated with the study by[21] in Japanese reported that consonant /k/ was the most occurring consonants in their study

In Table 6 Calicut dialect the alveolar nasals /ŋ/ with M=5.29 was the highest consonants compared to the Quilandi and coastal dialect. In Calicut dialect voiceless velar stop /k/ was more occurring consonant. This is in support of Malayalam study by[22] They found the /k/was the most occurring consonant in Calicut dialect. In Calicut dialect the alveolar nasals /ŋ/ with M=5.29 was the highest consonants compared to the Quilandi and coastal dialect. In Calicut dialect voiceless velar stop /k/ was more occurring consonant. This is in support of Malayalam study by [23] .They found the /k/was the most occurring consonant in Calicut dialect.

KruskalWallis Test							
consonants	□2	df	p-value	consonants	□2	df	pvalue
/K/	2.17	2	0.338	/ŋ/	0.81	2	0.667
/Kᶠ/	0.00	2	1.000	/ɲ/	1.31	2	0.519
/g/	3.35	2	0.188	/ɳ/	12.21	2	0.002
/gᶠ/	3.00	2	0.223	/n̪/	13.86	2	0.001
/c/	0.91	2	0.636	/m/	5.35	2	0.069
/cᶠ/	2.00	2	0.368	/j/	7.08	2	0.029
/ɟ/	3.70	2	0.157	/ɾ/	5.96	2	0.051
/ʈ/	4.94	2	0.085	/l/	9.42	2	0.009
/ʈᶠ/	-	-	-	/ʋ/	6.93	2	0.031
/ḍ/	4.72	2	0.095	/ʃ/	3.59	2	0.166
/ṭ/	5.40	2	0.067	/ʂ/	5.51	2	0.064
/tʰ/	1.91	1	0.167	/s/	14.58	2	0.001
/ḍ/	4.14	2	0.126	/h/	0.11	2	0.948
/ḍᶠ/	2.90	2	0.235	/ɭ/	3.18	2	0.204
/P/	9.58	2	0.008*	/ɻ/	2.07	2	0.355
/pʰ/	3.91	2	0.142	/r/	9.68	2	0.008
/b/	4.77	2	0.092	/n/	4.54	2	0.103
/bᶠ/	0.00	1	0.959	/t̪/	0.81	2	0.667

*Indicates significant at P< 0.05 ** Indicates significant at P<0.01
Table 8: Comparison of consonants across in each dialect of Malayalam using conversation task.

According to Table 8, there are several notable significant difference in consonants such as /p/, /ŋ̩/,/n̪/,/j/,/ʋ/,/s/,/r/ .

To examine the significant difference in the occurrence of consonants across the three dialects, non-parametric kruskal-wallis test was carried out .The result revealed that voiceless bilabial stop /p/ [☐2(2)= 9.58;p=0.008],showed the highest significant difference in coastal dialect followed by Quilandi and Calicut dialect. Retroflex nasals /ŋ/ [☐2(2)= 12.21;p= 0.002]showed the highest significant difference in Quilandi dialect compared to the other Malayalam dialect. Similarly for dental nasals /n̪/ [☐2(2)=13.86;p=0.001] showed the highest significant difference in Quilandi dialect compare to the coastal dialect and Calicut dialect. Palatal glide/j/ [☐2(2)= 7.08;p=0.029]when compared to the Calicut and Coastal dialect, the Quilandi dialect exhibited the greatest significant difference. Similarly when comparing Calicut and Coastal dialect laboidental approximant /ʋ/ [☐2(2)= 6.93;p=0.031] exhibited the most significant difference . Voiceless alveolar fricative /s/[☐2(2)= 14.58;p=0.001],showed the highest significant difference in Quilandi dialect followed by Calicut and Coastal dialect. Alveolar tap/r/[☐2 (2)=9.68;p=0.008],showed the highest insignificant difference in Quilandi dialect followed by Calicut and Coastal dialect.

However, Kruskal-wallis test was not significant for consonants (/k/,/kʰ/,/g/,/gʰ/c/,/cʰ/,/ɟ/,/t̪/,/d̪/,/t̪ʰ/,/ʈ/,/ʈʰ/,/ɖ/,/ɖʰ/,/pʰ/,/b/,/bʰ/,/ŋ/,/ɲ/,/m/,/ɾ/,/l/,/ʂ/,,/h/,/ɭ/,/ɻ/,/n/,/t̪/)

Mann-Whitney U test was performed to examine the significant difference across each pair of dialects as shown in Table 9

Mann-Whitney U						
Consonants	Calicut vs Quilindi		Calicut vs Coastal		Quilindi vs Coastal	
	|Z|	p-value	|Z|	p-value	|Z|	p-value
p	2.567	0.010*	2.784	0.005**	0.128	0.899
ŋ̩	2.327	0.020*	0.614	0.539	3.463	0.001**
n̪	3.538	0.000**	1.986	0.047*	2.056	0.040*
j	2.508	0.012*	1.525	0.127	1.362	0.173
l	1.805	0.071	1.318	0.188	2.927	0.003**
ʋ	2.581	0.010*	0.723	0.470	1.492	0.136
s	3.285	0.001**	0.485	0.628	3.067	0.002**
r	2.666	0.008**	0.131	0.896	2.429	0.015*

Table 9: Mann –Whitney U test: Dialect comparison for consonants

As seen in Table 4.2.2 for consonants, on pair-wise comparison of Calicut and Quilandi dialect voiceless bilabial stop /p/ showed the highest significant difference in Quilandi dialect of with M=16.35 ; SD=11.04 compared to the Calicut dialects with M=8.28;SD=4.53. Similarly for Retroflex nasals /ŋ/was showed the highest significant difference in Quilandi dialect of with M=11.05;SD=6.31compared to Calicut dialect with M=6.06;SD=5.45.Dental nasals /n̪/ showed the highest significant difference in Quilandi dialect with M=22.26,SD=11.59 compared to the Calicut dialect with M=9.06;SD=6.76.

The most significant difference was found in the Palatal glide/j/ in Quilandi dialect, with M=15.20; SD=9.75 compared to the Calicut dialect with M=7.80;SD=5.50.When comparing to the Calicut dialects with M=6.39;SD=4.80 the labiodental approximant /ʋ/exhibited the most significant difference in Quilandi dialect with M=10.40; SD=4.63. Voiceless alveolar fricative /s/ showed the highest significant difference in Quilandi dialect with M=6.10; SD= 4.00 compared to the Calicut dialect with M=3.72;SD=4.07,and Alveolar tap /r/ showed the highest significant difference in Quilandi dialect with M=7.55;SD= 4.088 compared to the Calicut dialect with M=4.13;SD= 2.36 . A study by[22] in French reported consonants /s/ and /r/ are the most occurring consonants. When comparing to the Quilandi dialect to the Calicut dialect, the Quilandi dialect has a higher significant production of consonants.

When comparing to Calicut and coastal dialect. voiceless bilabial stop /p/ showed the highest significant difference in coastal dialect with M=16.69;SD=11.91 compared to the Calicut dialect with M=8.28;SD=4.53,similarly Dental nasals /n̪/ showed the highest significant difference in Coastal dialect with M=15.11, SD=9.32 compared to the Calicut dialect with M=9.06;SD=6.76.An American Spanish study reported more occurring consonants were /p/and /n/ by[24] .When comparing to the Calicut and Coastal dialect, Coastal dialect has higher significant production of consonants

The retroflex nasals /ŋ/ showed the highest significant difference in Quilandi dialect of with M=11.05;SD= 6.31compared to Coastal dialect with M=3.73;SD =2.53 .Dental nasals /n̪/ showed the highest significant difference in Quilandi dialect with M=22.26,SD=11.59 compared to the Coastal dialect with M=15.11, SD=9.32. Voiceless alveolar fricative /s/ showed the high-est significant difference in Quilandi dialect with M=6.10;SD=4.00 compared to the Coastal dialect with M=2.73,SD=1.62 and Alveolar tap /r/ showed the highest significant difference in Quilandi dialect with M=7.55; SD=4.08compared to the Coastal dialect with M=3.88,SD=1.73. A western study conducted by[25] in conversational English found that this is in consonance with the /r/ and /s/ are the most occurring consonants in their study. When comparing to the coastal dialect, Quilandi dialects has a higher significant production of consonants.

IV. CONCLUSION

To conclude, the current study helps us to understand the most frequency of occurrence of phoneme in each dialects (Calicut, Quilandi, Coastal) in Calicut.

However, this study has its limitations; the study wasn't done on pediatric population it was only taken for adults which may also affect variation in adults.

REFERENCE

[1] Sarath, K. S., Nair, M. V., Rajeev, R. R., & Raj, P. R. (2014). Dialect resolution: A Hybrid Approach. *An International Journal of Engineering Sciences, Special Issue Dravadian, 15*

[2] Hayden, R. E. (1950). The relative frequency of phonemes in General-American English. *Word, 6(3), 217-223.*

[3] Sreedevi, N., Nair, S. K., & Vikas, M. D. (2012). Frequency of occurence of phonemes in kannada: *a preliminary study. Journal of the All India Institute of Speech & Hearing, 31*

[4] Vel, S. S., Mubarak, D. M. N., & Aji, S. (2015, December). A study on vowel duration in Tamil: Instrumental approach. *In 2015 IEEE International Conference on Computational Intelligence and Computing Research (ICCIC) (pp. 1-4). IEEE*

[5] Ghatage, A. M. (1964). Phonemic and morphemic frequencies in Hindi (*Vol. 2). Deccan College Postgraduate and Research Institute.*

[6] Kalyani, N., & Sunitha, D. K. (2010). Syllable analysis to build a dictation system in Telugu language. *arXiv preprint arXiv: 1001.2263.*

[7] Sreedevi, N., & Irfana, M. (2013). Frequency of occurrence of phonemes in Calicut and Ernakulam dialects of Malayalam. *Journal of the All India Institute of Speech & Hearing, 32.*

[8] Sreedevi, N., & Irfana, M. (2013). Frequency of occurrence of phonemes in Calicut and Ernakulam dialects of Malayalam. Journal of the All India Institute of Speech & Hearing, 32.

[9] Maitreyee, R., & Goswami, S. P. (2009). Language proficiency questionnaire: *an adaptation of LEAP-Q in Indian context*

[10] Guirao, M., & García Jurado, M. (1990). Frequency of occurence of phonemes in American Spanish. *Revue quebecoise de linguistique, 19(2), 135-149.*

[11] Sreedevi, N., & Irfana, M. (2013). Frequency of occurrence of phonemes in Calicut and Ernakulam dialects of Malayalam. *Journal of the All India Institute of Speech & Hearing, 32.*

[12] Guirao, M., & García Jurado, M. (1990). Frequency of occurence of phonemes in American Spanish. Revue quebecoise de linguistique*, 19(2), 135-149.*

[13] Sreedevi, N., & Irfana, M. (2013). Frequency of occurrence of phonemes in Calicut and Ernakulam dialects of Malayalam. *Journal of the All India Institute of Speech & Hearing,*

[14] Tamaoka, K., & Makioka, S. (2004). Frequency of occurrence for units of phonemes, morae, and syllables appearing in a lexical corpus of a Japanese newspaper. *Behavior Research Methods, Instruments, & Computers, 36(3), 531-547.*

[15] Kumar, S. R., & Mohanty, P. (2012). Speech recognition performance of adults: a proposal for a battery for telugu. *Theory and Practice in Language Studies, 2(2), 193.*

[16] Tokuhiro, Y., & Hiki, S. (2004, December). Effects of mora phonemes on Japanese word accent. *In Proceedings of the 18th Pacific Asia Conference on language, information and computation (pp. 243-250).*

[17] Kumar, S. R., & Mohanty, P. (2012). Speech recognition performance of adults: a proposal for a battery for telugu. *Theory and Practice in Language Studies, 2(2), 193.*

[18] Kalyani, N., & Sunitha, D. K. (2010). Syllable analysis to build a dictation system in Telugu language. *arXiv preprint arXiv: 1001.2263.*

[19] Sreedevi, N., Nair, S. K., & Vikas, M. D. (2012). Frequency of occurence of phonemes in kannada: a preliminary study. *Journal of the All India Institute of Speech & Hearing, 31*

[20] Palai, E. B., & O'Hanlon, L. (2004). Word and phoneme frequency of occurrence in conversational Setswana: *a clinical linguistic application. Southern African Linguistics and Applied Language Studies, 22(3-4), 125-142*

[21] Tamaoka, K., & Makioka, S. (2004). Frequency of occurrence for units of phonemes, morae, and syllables appearing in a lexical corpus of a Japanese newspaper. *Behavior Research Methods, Instruments, & Computers, 36(3), 531-547*

[22] Sreedevi, N., Nair, S. K., & Vikas, M. D. (2012). Frequency of occurence of phonemes in kannada: *a preliminary study. Journal of the All India Institute of Speech & Hearing,*

[23] Sreedevi, N., Nair, S. K., & Vikas, M. D. (2012). Frequency of occurence of phonemes in kannada: a preliminary study. Journal of the All India Institute of Speech & Hearing,

[24] *Malécot, A. (1974). Frequency of occurrence of French phonemes and consonant clusters. Phonetica, 29(3), 158-170.*

[25] Guirao, M., & García Jurado, M. (1990). Frequency of occurence of phonemes in American Spanish. Revue quebecoise de linguistique, 19(2), 135-149.

[26] Mines, M. A., Hanson, B. F., & Shoup, J. E. (1978). Frequency of occurrence of phonemes in conversational English. Language and speech, 21(3), 221-241.