P-ISSN 2708-6453	Pakistan Languages and Humanities Review	Oct-Dec 2023, Vol. 7, No. 4
O-ISSN 2708-6461	https://doi.org/10.47205/plhr.2023(7-IV)28	[330-339]

Pakistan Languages and Humanities Review
www.plhr.org.pk

RESEARCH PAPER

Analysis of English Phonological Performance between Sindhi Male and Female Learners

[1]Muhammad Ashraf Joyo* and [2]Dr. Rafique Ahmed Memon

1. PhD Student, Institute of English Language and Literature University of Sindh, Jamshoro, Sindh, Pakistan
2. Pro-Vice Chancellor, University of Sindh, Campus Thatta, Sindh, Pakistan

***Corresponding Author** joyoashraf@gmail.com

ABSTRACT

This paper presents acoustic analysis of twenty English vowels and diphthongs i.e. /ʌ/, /ɑ: /, /æ/, /e/, /ə/, /3:/, /I /, /i: /, /ɒ/, /ɔ:/, /ʊ/, /aʊ/, /əʊ/, /u:/, /aɪ/, /eɪ/, /ɔɪ/, /eə/, /ɪə/ and /ʊə / produced by Second Language learner Sindhi speakers. This paper analysis acoustic realization of Sindhi speaking undergraduates between male and female. It investigates as to how much acoustic difference is between male and female speakers regarding formant one (F1) and formant two (F2). The study uses the parameters of vowel quality formant one and formant two (F1 & F2). The information was gathered via collecting voice samples from 30 subjects (fifteen male and fifteen female) from University of Sindh campus Nasuhahro Feroze, Sindh. The study focuses the height and the quality of vowels and diphthongs to determine the acoustic difference between them. The study finds that the F1 and F2 values of female participants are higher than the male participants. The hypothesis was that the production of the vowels and diphthongs of male and female differ from each other.

KEYWORDS Acoustic, Diphthong, Formant, Speaker, Vowel

Introduction

English is a lingua franca of the word. It belongs to West Germanic language routed from Indo-European language family. It is spoken by the peoples of all continents (Encyclopedia Britannica, 2002).

The English language assumes a crucial role in enabling academic and professional achievements within the context of our contemporary globalised society. The scope of English grows significantly beyond the geographical boundaries of English-speaking nations, thereby establishing it as the predominant language for global communication (Lashari et al, 2017). English serves as the primary medium of teaching in numerous respected universities and research institutions across the globe within the academic domain. Consequently, possessing a high level of English language competence is frequently a requirement for obtaining acceptance into prestigious academic programmes and engaging in research collaborations with academics who come from various linguistic origins (Lashari, Umrani & Buriro, 2021).

The attainment of a high level of English proficiency is of equal importance in achieving professional success. Numerous prominent multinational corporations engage in their business activities using the English language, hence emphasizing the significance of proficient English language abilities for individuals seeking employment opportunities in the global labour market (Lashari & Umrani, 2023). Moreover, within disciplines such

as science, technology, engineering, and medicine, a substantial proportion of scholarly literature is disseminated in the English language. Consequently, it is imperative for practitioners in these domains to possess a high level of proficiency in English in order to remain up-to-date with the most recent advancements and actively contribute to their respective areas of expertise (Lingua. 2022).

The individuals with the highest level of education aspire to communicate with the BBC or Received Pronunciation (RP) accent, which is widely regarded as the standard accent. English is often spoken in numerous diverse dialects and accents throughout the globe (Lashari & Umrani, 2023). Oral fluency in English in Pakistan, particularly in context of Sindh has been considered as symbol of competency and educated person (Lashari et al., 2017; Lashari, Umrani & Buriro, 2021). The learners have to be fluent in English language (Ahmed, Lashari & Golo, 2023) for their academic and professional success. The study is novel in nature because there is huge gap in the comparison between the Sindhi male and female speakers English spoken language.

The study mostly focuses on phonetic acoustic variance between male and female frequencies. The sounds articulated as vowel or diphthong sounds without restriction of air mechanism from lungs via vocal track. According to Ladefoged (1993), these variations could be viewed as a variety of pitches, but they also distinguish themselves from one another due to two characteristics: pitches connected to their overtones.

In this study, Praat Speech Processing is used to assess the acoustic parameter of English vowels and diphthongs between male and female participants. Formant one frequency correlates with the height of the tongue, whereas the Formant two indicates how backward the vowel appears. The results of the prior study indicated cross-gender differences. This study utilises the Praat Speech Processing Tool, developed by Paul Boersma and David Weenink in 2016, to investigate the acoustic characteristics of vowels. Specifically, the study focuses on the relationship between the Formant-1 frequency, which represents the height of the tongue, and the Formant-2 frequency, which indicates the backness of English vowels and diphthongs. The study compares male and female Sahiti Sindhi speakers of English in terms of the height (F1) and quality (F2) of these vowels.

It has been observed that the F1 and F2 of the female speaker is higher than the male speaker as Hillenbrand (1995) says that the female speakers' vowel formant are typically found at higher frequency. Farmersant-0 range values for female speakers are reportedly bigger than those for male speakers (Takefula, 1970) and (Olsen, 1981). The fundamental frequency of vocal fold vibration was found doubled as from 120Hz to 24Hz (Miller, 1953)

Literature Review

Plenty of research is available on phonological issues assessed through acoustic analysis. Comparison and contrast of acoustic analysis of native English vowel and diphthong sounds with other languages has also been conducted by many researchers to find out the variation between the native speakers and others who speak English with their own accent.

Hussain (2010) and Abbasi (2015) reveal that as for as the second language English learners are concerned, much work is not done in South Asian regions whereas sufficient work has been done on Pakistani spoken languages. However, scientific approach is prerequisite to look at the basic acoustic indications for the speech assessment.

Formants are regarded as vocal tract resonances by acoustic theory (Fant, 1060) as the voice waves' energy concentration places. The primary goal of the research is to compare the formant-1 and formant-2 patterns between male and female Sindhi speakers of English.

The research in question is to study of vowel quality (F1-F2). Takefuta et al. (1070) reveals that the mean of F0 could be around 120Hz for men and 200Hz for women, moreover, these values may slightly differ with the passage of age as argued by Pegoraro-Crook (1988) and become generally lower for smokers as noted by Gilbert and Weismer (1974). The previous studies conducted on acoustic assessment recognized the fact that acoustic variation between male and female vowel system have been the result of biophysical and socio-phonetic factors. The female speakers has larger acoustic area which creates acoustic difference between male and female frequency. In particular, the formant magnitude increases the acoustic disparities between male and female tokens of the same vowel category: the F1 difference increases with vowel openness, whereas the F2 difference increases with vowel frontless. Sometimes the difference between male and female spears F1 and F2 is almost vanishes as Fant (1985) reveals that female speaker lower the formant values of the back vowels for instance [o:] and [u:] consequently getting both of them closer to each other in F1 and F2 values by using tighter and longer dorso-velar and labial structures, manipulating the double Helmholtz resonate or like the properties of these vowel types.

According to Abercrombie (1967) and Laver (1980), the 'voice quality' has a broad range of potential meanings. This study assessed the variation between male and female speakers but before this, assessment of voice quality of women and children have not been preferred in such research. One explanation is that formant frequencies are typically the focus of acoustic studies as indicators of phonetic variations. Estimating formant-frequency locations is more challenging in women and children because to their higher fundamental frequencies. Besides, unofficial observations suggest that vowel variations derived from female voices may not fit as well into an all-pole model because of tract interactions and tracheal coupling (Fant, 1985; Klatt, 1986).

According to Kirk et al. (1984), laryngealization is one of the distinguishing features of tone 3 in Mandarin Chinese, the phonemic use of glottal-stop or glottalization gestures in Danish, and the contrastive use of panting versus normal vowels in languages like Gujarati (Pandit, 1964; Fischer-Jorgensen, 1967).

This researcher paper represents further research trying to find out the difference in male and female F1 and F2 of Sindhi speaking English speakers of undergraduates of University of Sindh Campus Naushahro Feroze. The subjects have been selected from Standard Sindhi which is also called Vicholi or Sahiti speaking community out of the five dialects of Sidnhi, spoken in Sindh, Pakistan. The study determines whether the male and female vary in their frequency as the other similar studies found variation before the studies.

Hypothesis

There may be variation between male and female Sindhi speaker of English language in production of vowels and diphthongs in F1 and F2 height and quality of the speech.

Material and Methods

Thirty undergraduate participants (15 male and 15 female) having age ranged from 19 to 24 years were taken from University of Sindh, campus Naushahro Feroze for recoding their voice sample on laptop. The researcher used Speech Processing device PRAAT having 64-bit edition 6.0.19 by Paul Boersma and Devid Weenink (2016) and recorded 315 voice samples for assessment accordingly.

Speech Material

Mono-Syllabic words were selected in CVC and CVCC pattern for acoustic analysis.

1.	/ ʌ/	nut	hut	luck	duck	suck
2.	/ɑ:/	Farm	card	guard	far	hard
3.	/æ/	sat	gap	cat	black	bland
4.	/e/	tend	pet	met	bed	head
5.	/ə/	women	about	dollar	hostess	second
6.	/ɜ:/	shirt	dearth	turn	learn	birth
7.	/ɪ /	lit	inner	hit	sitting	submit
8.	/i /	happy	easy	apply	city	shady
9.	/i:/	heat	deep	feet	seat	see
10.	/ɒ/	offer	short	hot	rock	lot
11.	/a:/	ball	hall	call	tall	saw
12.	**/ʊ/**	look	hook	Put	cook	shook
13.	**/u:/**	june	blue	glue	soon	noon

The Mono-syllabic words consisting of Diphthongs were selected in Pattern CVC.

/ɪə/	rear	hear	dear	where,	near	
/eə/		dare	rare	clear	mare	share
/ʊə/		sure	tour	poor	your	cure
/ɔɪ/		Joint	polite	light	time	soil
/əʊ/		rope	known	hope	jolt	loan
/aʊ/		down	clown	pouch	loud	shout
/eɪ/		Pain	gain	page	tail	sale
/aɪ/		five	dive	live	pile	dive

Procedure

The respondents received brief instructions on how to record their voice samples along with a list of words written on A4 size paper for recording purposes. They were requested to read out three times each word to get the average of all the three voices of the same word.

Their speech samples were recorded using the laptop Praat Speech Processing tool. In order to minimize the sound of their lips moving and their breathing, they were also directed to keep the microphone three to four inches away from their mouth. A noise-free area was used to record the voice sample.

Data Analysis

The data were analyzed by measuring auto-check system navigating through options of their F1 and F2 values. Sometimes, F1 and F2 were determined manually using spectrographic red light dots on Praat as point of F1 and F2 values. Later on, the speakers F1 and F2 values were taken to Excel file to know their individual differences and male and female differences. Ultimately, the thirty speakers' data were statistically measured using the t-test, and the results were compared between the male and female speakers for getting F1 and F2 values in order to find their probability p-value. The total voice samples words were 105. The researchers took three token of each voice sample thus, (105X3= 315) so, total 315 voice samples were taken, measured, compared with each other. The summary of the results is presented in form of tables and bar charts as under:

Table 1
Mean values of F1 of seven English vowels of male and female speakers

Vowels	Sound	Male speakers	Female speakers	p- values
Duck	/ʌ/	733.66	779.92	0.298
Card	/ɑ:/	927.28	1008.00	
Cat	/æ/	567.08	617.99	
Bed	/e/	685.72	615.90	
Dollar	/ə/	809.58	756.50	
Learn	/ʒ:/	658.40	863.28	
Hit	/I/	448.1	463.7	
Total Mean		679.97	735.03	

On comparison of male and female speakers' F1 values, it is found that the female speakers' F1 values were greater. P-Value was deemed significant when P-Value is greater than 0.05. The analysis demonstrates that the findings are not significant. The voice sample used to acquire the data collected from undergraduate Sindhi (Sahiti Dialects) speakers.

Table 2
Mean values of F2 of seven English vowels of male and female speakers

Vowels	Sound	Male speakers	Female speakers	p- values
Duck	/ʌ/	1500.49	1639.2	
Card	/ɑ:/	1492.75	1590.67	0.017
Cat	/æ/	2148.4	2190.67	
Bed	/e/	1974.13	2105.90	
Dollar	/ə/	1719.4	1871.88	
Learn	/ʒ:/	1721.3	1666.4	

Hit	/I/	2183.31	2358.06
Total Mean		1819.96	1917.54

On comparison of male and female speakers' F2 values, it is found that the female speakers' F2 values were greater. P-Value is deemed significant when P-Value is greater than 0.05. The analysis demonstrates that the findings are not significant. The voice sample used to acquire the data collected from undergraduate Sindhi (Sahiti Dialects) speakers.

Table 3
Mean values of F1 of seven English vowels of male and female speakers

Vowels	Sound	Male speakers	Female speakers	p- values
Study	/i /	470.61	537.83	0.698
eat	/i:/	489.61	577.83	
offer	/ɒ/	702.27	723.52	
call	/ɔ:/	627.47	710.88	
look	/ʊ/	480.77	524.89	
Eye	/aɪ/	641.00	425.00	
Now	/aʊ/	640.99	666.34	
Total Mean		578.96	595.18	

On comparison of male and female speakers' F1 values, it is found that the female speakers' F1 values were greater. P-Value was deemed significant when P-Value is greater than 0.05. The analysis demonstrates that the findings are not significant. The voice sample used to acquire the data collected from undergraduate Sindhi (Sahiti Dialects) speakers.

Table 4
Mean values of F2 of seven English vowels of male and female speakers

Vowels	Sound	Male speakers	Female speakers	p- values
Study	/i /	2250.84	2238.71	0.05
eat	/i:/	2279.84	2358.71	
offer	/ɒ/	1135.02	1161.62	
call	/ɔ:/	1330.60	1337.3	
Look	/ʊ/	1413.61	1597.43	
Eye	/aɪ/	1129.15	1472.29	
Now	/aʊ/	1405.30	1732.46	
Total Mean		1563.48	1699.78	

On comparison of male and female speakers' F2 values, it is found that the female speakers' F2 values were greater. P-Value is deemed significant when P-Value is greater than 0.05. The analysis demonstrates that the findings are significant. The voice sample used to acquire the data collected from undergraduate Sindhi (Sahiti Dialects) speakers.

Table 5
Mean values of F1 of seven English vowels of male and female speakers given below

Vowels	Sound	Male speakers	Female speakers	p- values
Soon	/u:/	336.30	400.07	0.006
page	/aɪ/	566.61	566.61	
go	/əʊ/	513.10	577.51	
toy	/ ɔɪ/	513.73	571.44	

Share	/ eə/	477.17	579.00
Dear	/ɪə/	430.835	555.56
Sure	/ʊə/	441.98	476.84
Total Mean		468.53	532.43

On comparison of male and female speakers' F1 values, it is found that the female speakers' F1 values were greater. P-Value was deemed significant when P-Value is greater than 0.05. The analysis demonstrates that the findings are highly significant. The voice sample used to acquire the data collected from undergraduate Sindhi (Sahiti Dialects) speakers.

Table 6
Mean values of F2 of seven English vowels of male and female speakers

Vowels	Sound	Male speakers	Female speakers	p- values
Soon	/u:/	1169.29	1472.15	0.02
page	/eɪ/	2002.00	2057.62	
go	/əʊ/	1126.92	1187.58	
toy	/ ɔɪ/	985.25	1149.25	
Share	/ eə/	1860.90	2191.19	
Dear	/ɪə/	2271.13	2729.93	
Sure	/ʊə/	1892.71	1904.06	
Total Mean		1615.45	1813.11	

On comparison of male and female speakers' F2 values, it is found that the female speakers' F1 values were greater. P-Value was deemed significant when P-Value is greater than 0.05. The analysis demonstrates that the findings are highly significant. The voice sample used to acquire the data collected from undergraduate Sindhi (Sahiti Dialects) speakers.

Discussion

The study analyzes the vowels and diphthongs production of male and female speakers' and to highlight the difference between them in terms of formant frequency (F1 and F2) frequencies. The data are determined manually and by auto-check system navigating through options on Speech Processing Tool Praat Software in order to ensure reliability. Finally the data are measured statically by applying t-test and compared between male and female to find their p-value. The study finds that there was a minor difference in production of the phonemes /ʌ/, /ɑ:/, /æ/, /e/, /ə/, /3:/,

/ **I /** in formant frequency F1 and F2 between male and female participants and major difference in production of the vowels and diphthongs i.e. /i: /, /ɒ/, /ɔ:/, /ʊ/, /aʊ/, /əʊ/, /u:/, /aɪ/, /eɪ/, /ɔɪ/, /eə/, /ɪə/ and /ʊə/.

Conclusion

The study concludes that there is not significant different in production of phonemes /ʌ/, /ɑ:/, /æ/, /e/, /ə/, /3:/, / **I /** but there is highly significant difference in production of phonemes i.e. /i: /, /ɒ/, /ɔ:/, /ʊ/, /aʊ/, /əʊ/, /u:/, /aɪ/, /eɪ/, /ɔɪ/, /eə/, /ɪə/ and /ʊə/ between the male and female speakers in formant frequency F1 and F2.

Recommendations

The present study assesses the phonological performance of English learners of Sindhi standard (Sahiti) dialect only. The F1 and F2 of vowels and diphthongs of English have been analyzed and the variation occurred between the male and female speakers have been established. Apart from this research, enormous research can be conducted on vowel and consonant sounds of the other Sindhi dialect speakers to find out the difference among them. The experimentation demonstrates that the two-dimensional features i.e. F1 and F2 are not sufficient to distinguish among the six accents spoken in Sindh's various dialects and geographical areas. Aftermath, the researcher suggests exploring additional voice data dimensions**.**

References

Abbasi, A. M, & Hussain, S. (2015). *Phonetic analysis of lexical stress in Indo-Aryan language. Sindh University Research Journal-SURJ*, 47 (4), 749-756.

Ahmed, I., Lashari, A. A., & Golo, M. A. (2023). *Evaluating Primary-Level English Textbooks of Single National Curriculum through the Lens of Bloom's Taxonomy. Pakistan Languages and Humanities Review, 7(3), 352-361.*

Abercrombie, D. (1967). *Elements of General Phonetics. Edinburgh University Press. Boersma,*

Fant, G. (1985). Speech technology - research and development. Presentation at the occasion of the Ericsson Prise 1985, Ericsson Review, 1, 99-107.

Fischer-Jorgensen, E. (1967). *Phonetic analysis of breathy (murmured) vowels in Gujarati, Indian Linguistics 28, 71-139.*

Gilbert, H.R., and Weismer, G.G. (1974). *The effects of smoking on the speaking fundamental frequency of adult women, J. Psycholing. Res. 3, 225–231.*

Gottfried, T. L., & Chew, S. L. (1986). *Intelligibility of vowels sung by a countertenor. Journal of the Acoustical Society of America 79(1), 124-130.*

Hillenbrand, J., Getty, L.A., Clark, M., & Wheele, K. (1995). *Acoustic characteristics of American English vowels. Journal of Acoustical Society of America, 97 (5), 3099- 30111.*

Klatt, D.H. (1986). *A spreading-activation theory of retrieval in sentence production. Psychological Review, 93(3), 283-321.*

Ladefoged, P. (1973). *The features of larynx, Journal of Phonetics, I, 73-83.*

Ladefoged, P. & Antoñanzas-Barroso, N. (1985). *Computer measures breathing phonation. UCLA Working Papers in Phonetics 61, 79-86.*

Ladefoged, P. (1993). *A course in phonetics (3 ed.). Harcourt College Publishers, New York.*

Lashari, A. A., Mashori, G. M., Abbasi, A. M., & Talpur, Q. (2017). *Motivation to Learn English Language: A Study of Shah Abdul Latif University, Khairpur, Sindh. International Journal of English Linguistics, 8(1). 24-25*

Lashari, A.A., & Umrani, S. (2023). *Reimagining self directed learning language in the age of Artificial Intelligence: A Systematic Review. Grassroots, 1, 92-93*

Lashari, A. A., Umrani, S., & Buriro, G. A. (2021). *Learners' self-regulation and autonomy in learning English. Pakistan Languages and Humanities Review, 5(2), 115.*

Laver, J. (1980). *The Phonetic Description of Voice Quality. Cambridge: Cambridge University*

Press. Lehiste, I. & Meltzer, D. (1973) *Vowel and speaker identification in natural and synthetic speech. Language and Speech 16, 356-364.*

Miller, R.L. (1953). *Auditory tests with synthetic vowels. Journal of Acoustical Society of America, 25, 114-121.*

Pandit, P.B. (1964). *Nasalization, aspiration and murmur in Gujrati, Indian Linguistics, 17, 165-172.*

Pegoraro-Krook, M. 1. (1988). "*Speaking fundamental frequency characteristics of normal Swedish subjects obtained by glottal frequency analysis," Folia Phoniatrica 40, 82–90.*

Stevens, K. N. (1981). *Constraints imposed by the auditory system on the properties used to classify speech sounds: Data from phonology, acoustics, and psychoacoustics. In T. Myers, Laver, J & J. Anderson (Eds.), The cognitive representation of speech (pp. 61–74). New York: North-Holland Publishing Co.*