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SEGMENTAL STUDY OF PUNJABI GLOTTAL FRICATIVE /H/: AN ACOUSTIC ANALYSIS OF GLOTTAL FRICATIVE IN MAJHI AND LEHNDI DIALECTS OF PUNJABI

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ABSTRACT

The present work is based on the Punjabi glottal fricative /h/. In this study, the researcher has compared the acoustic properties of one Punjabi phoneme /h/ in, both, Majhi and Lehndi dialects. The main aim of this study is to check the acoustic differences of glottal fricative in Majhi and Lehndi dialects. The data was gathered from 10 participants of Majhi and 10 of Lehndi dialect. The given words were containing /h/ initially, medially and finally and all of these words were used in the sentences in order to gain the natural data. Researcher asked the contributors to read the sentences loudly in their own Punjabi dialect for three times. The data was collected with the help of recorder in a very relax environment. With the help of Praat software, the recorded data was analysed. In order to get the mean about different values, further SPSS was used. The results of this study show that /h/ assimilates with its vowels progressively and regressively. This study also reveals that in Majhi dialect, people merge glottal fricative /h/ with the neighboring vowel in all positions while the speakers of Lehndi dialect merged the glottal fricative /h/ at words initial position only.

Keywords: glottal fricative, acoustic features, Majhi dialect, Lehndi dialect

INTRODUCTION

The biggest province of Pakistan is Punjab and the language which is mostly spoken in this province is known as Punjabi language. The speakers of Punjabi language are more than 500 million. Due to the occurrences of historical and geographical changes in the land of Punjab, there is difference in the dialects of Punjabi. It is also influenced by Persian and Arabic language. These dialects are nine in number such as Majhi, Pothohari, Chhachhi, Saraiki, Dhani, Lehandi, Doabi, Malwai and Shahpuri. The most prestigious dialect is Majhi dialect which is spoken, usually, in Lahore. The different names of Punjabi are Multani, Hindhi and Lahori. The word Punjabi was

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first used by Hafiz Babar in his book "Maftahulfiqa". Josan and Lehal (2010) stated that the script of Punjabi language is "Gurumukhi" which means "from the mouth of the Guru" and Shahmukhi. Usually, Shahmukhi script is used in Pakistan while the Gurumukhi script is used in India in order to write Punjabi language. It consists of 32 consonants below is the table of Punjabi consonants.

TABLE 1 Consonant of Punjabi

	Bilabial	Labiodental	Dental	Alveolar	Retroflex	Palatal	Velar	Glotal
Plosive	p		t̪		ʈ	tʃ	k	
	pʰ		t̪ʰ		ʈʰ	tʃʰ	kʰ	
	b		d̪		ɖ	dʒ	g	
Nasal	m			n	ɳ		ŋ	
Fricative		f		s		ʃ	x	h
		v		z			ɣ	
Trill				r				
Flap					ɾ			
Approxi-mate				l	ɭ	j		

From the above table, it is clear that there are five fricatives of Punjabi language but this study aims, exclusively, to focus on the glottal fricative /h/. Glottal fricative carries those features that keep Punjabi language separate from other languages. A fricative is such a sound that can be prolonged as much as the speaker wants. In order to produce fricatives, air passes through the narrow passage and as a result there is clear and audible friction. Glottal fricative is voiceless at word's opening and ending point but voiced / voiceless at word's middle position. As Ladefoged (2001) explained the English glottal fricative,

"In English /h/ is somewhat like the voiceless counterpart of the surrounding sounds. At the beginning of a sentence /h/ is like a voiceless vowel, but /h/ can also occur between vowels in words or phrases like "behind the head". As you move from one vowel through /h/ to another, the articulatory movement is continuous and the /h/ is signaled by a weakening of the sound which may not even result in a completely voiceless sound".

The features of glottal fricative /h/ vary from one dialect to other. In Punjabi, glottal fricative can come at word's final position but this is not the same in English (Gussenhoven, 1998). All of the speakers of Punjabi dialects omit /h/ when it comes at words middle and ending position such as Lehndi. But speakers of Majhi dialect replace /h/ with neighboring vowel in all positions. This feature is peculiarly associated with Majhi dialect. So when there is stress on the vowel following /h/, then the glottal fricative is omitted.

In this study, the existence as well as the absence of glottal fricative has been discussed in details in Majhi and Lehndi dialects. The phonological realizations of glottal fricative /h/ in Majhi dialect

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have been compared with Lehandi dialect. This study aims, on the basis of phonetics, to examine the absence and presence of glottal fricative in Majhi and Lehandi dialects at words different positions respectively. The phonological realizations of one variable have been discussed with the help of social variables such as age and gender. It is expected that this study will add new information about glottal fricative in the body of previous literature.

The research questions of this study are:-

1. In Majhi dialect, /h/ glottal fricative or glottal approximant in nature?
2. How Majhi dialect is different from Lehndi dialect?

LITERATURE REVIEW

Previous studies helped the researcher to work on novel issues and find the right place for research. In this study, the review of earlier studies on glottal fricative help to discover the research gap and gives a direction to move on further. Ladefoged (1982) stated that "[h] is not a glottal sound but it is a voiceless counterpart of the following sound". Glottal fricative /h/ has very minute friction whenever it is pronounced at word's initial position but when /h/ comes at word's medial and final position then the formants of /h/ are very much similar to vowels (Keating, 1988). Ladefoged (1990) provides extra information about glottal fricative by stating that "/h/ has very little friction at the glottis and turbulent airflow is due to cavity friction rather than local friction at a particular point of production". Fricative /h/ has very little friction as compare to other fricatives such as /f/, /v/, /s/, /z/ etc that's why /h/ is considered as approximant rather than fricative. "/h/ and /ɦ/ stay where they are as glottal fricatives—honorary glottal fricatives, if you like! My reason for wanting to keep /h/ and /ɦ/in the chart is perhaps more phonological and practical than strictly phonetic. There are so many languages in which one or both of these sounds functions as a syllabic margin" (Catford, 1990). These different views demand further verification and analysis in order to label /h/ as fricative or approximant. Roach (1983) stated that "/h/ is a voiceless vowel with the quality of the voiced vowel that follows it". Praat software shows the spectrogram of /h/ differently from other fricatives because "the vowel shape to the follow the beginning to be formed before the production of the frication; this shape will change for different vowels and thus affect the spectrum of the [h]. The close front vowel the source of the [h] turbulence may be at a velar or upper pharyngeal location rather than low in the pharynx or at the glottis" (Pickett, 1999). Fricative /h/ is different from other fricatives only because of friction. According to Maddison (1996), /h/ cannot be termed as approximant because "voiceless approximants are by definition inaudible and if there is no friction, no voicing then there is nothing to hear. Anything you can hear during a voiceless /h/ must be some sort of weak friction, resulting from some sort of weak turbulence, which means that /h/ is some sort of weak fricative but still a fricative not an approximant".

Pandey, Mahesh and Dutta (2017) worked on Hindi language in order to check the deletion of /h/ as well as the deletion of neighboring vowel. A list of 22 words by 8 speakers was analysed with the help of Praat software and resulted that the deletion of vowel is an exceptional case but the

dropping of /h/ is exclusively associated with its adjoining vowels. Jarrah (2013) conducted a study on the fricatives of Arabic language. This study gives a detailed and thorough discussion about the fricatives in Arabic and it also shows that how fricatives are pronounced. This study helps the novel readers to know about Arabic fricative in a very short period of time. According to Vaux (1998), voiceless fricatives are produced with the help of open glottis. The open glottis does not show the difference between aspirated plosives vs. un-aspirated ones but this feature is associated with voiceless fricatives and aspirated consonants. So this study recommends that, further, researchers should focus on those features which help in distinguishing aspirated consonants from others. Dixit and MacNeilage (1974), conducted a study in Hindi on the articulation of two plosives such as /p/ and /b/ and on glottal fricative. Their study showed that fricative is produced with the help of open glottis while plosives are produced with or without open glottis. Fricatives do not involve the vibrating cords but plosives do. Overall this study helps to identify the glottal features of fricatives and plosives. Elramli (2012) conducted a study on three phonemes of Arabic language such as /ɣ/, /ʕ/ and /h/ and analysed them with the help of optimality theory. The aim of this study is to check either the phonemes such as /ɣ/ and /ʕ/ becomes devoiced when they precede /h/ or not. This study shows that not only uvular and pharyngeal change their sounds but /h/ also becomes as /ħ/ or /x/. This study showed the progressive as well as the regressive assimilation of the above mentioned phonemes.

Fricatives can be viewed along with higher vibration and it affects the size of oral cavity (Davenport, 2005). Fricatives can be identified by cavity size (Pickett, 1999). Fricative produces narrow formants in the cavity because of chaotic and turbulent air (Kent, 1996). All these viewpoints of fricatives show that the spectral shape of fricative as well as the duration and formants are important to recognize the fricative consonants. Rashid conducted a study on the consonants of Hindko and focused on the acoustic cues of all consonants. He also focused on the acoustic properties of Hindko fricatives and identified that how fricatives have different phonological realizations from other consonants such as stops and affricates etc. The results of this study revealed that duration, formants and noise are important clue to identify fricative differently from other consonants. Fricatives have no spikes on spectrogram. /h/ has lower amplitude as well as weak noise as compared to other fricatives (Yavas, 2006). On the basis of same grounds, another study was conducted by Gorden in 2002. In order to check the duration, formants and shape of spectrograms, Gorden (2002) conducted a study on fricatives in different languages. He found that the spectrogram shape is very important as compare to other qualities. Raphael (2007) stated that in spectrogram, the longer period of noise is just because of troubled air. Fricatives have faint formants on the spectrogram (Gut, 2009).

METHODOLOGY

The research design of this study is descriptive in nature. This is qualitative as well as quantitative study because it is spectrographically and statistically analysed. This study is limited to the segmental features of glottal fricative and further, these features have been examined in, both, Majhi and Lehndi dialect comparatively. “It is not a program to convert ignorance to knowledge,

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but a set of strategies for handling a rich data. It means the applications of techniques from data collection to generalizations (Labov, 1972, 97)".

In this study, 20 participants took part willingly. 10 participants from both, Majhi and Lehndi, dialects include five males and five females. As Roach stated (2000), "If we study only one or two speakers, it is likely that our results will not be typical of other speakers". All of the participants were, nearly, forty years of age. This study contains participants from Majhi and Lehndi dialect whose age ranged from 40 to 60 years.

Contributors were given a list of ten Urdu sentences which contains glottal fricative /h/ at words initial, middle and final position. The glottal fricative contains a vowel preceding or following it. They were asked to read the given list of sentences in their own dialect and were asked to repeat the sentences for three times in order to remove the errors of all type. The spoken data by the participants was recorded by using high quality microphone. The recorder was used without the permission of participants in order to remove their level of consciousness. According to Labov, "to obtain the data most important for linguistic theory, we have to observe how people speak when they are not being observed".

The data was recorded in a very relax and peaceful environment. Participants produced 600 tokens (10 sentences x 3times x 20 respondents) and the given data was analysed by using Pratt software with the frequency of 0 to 8000 Hz and SPSS was also used. The recording of each participant was saved in a separate file in order to analyse it with care. This study is limited to the glottal fricative of Majhi and Lehndi dialect.

DATA ANALYSIS

The data has been gathered from the participants of two dialects such as Majhi and Lehndi. In order to answer the first research question, the data has been analysed by using Praat software. Spectrogram helps in identifying that either the fricative /h/ is glottal or approximant in nature when it comes with vowels with fronting or ending position. With the help of SPSS, second research question has been analysed. It helps in making the differences between two dialects on the basis of age and gender of the participants also. Below is the list of words containing glottal fricative /h/ at words initial, middle and final positions.

Initial "haa" sound	**Middle "haa" sound**	**Final "haa" sound**
"haathi"	"bahany"	"tənxwah"
"hathora"	"bahaal"	"parwaah"
"haalat"	"suhana"	"aagah"
	"be-bahaa"	

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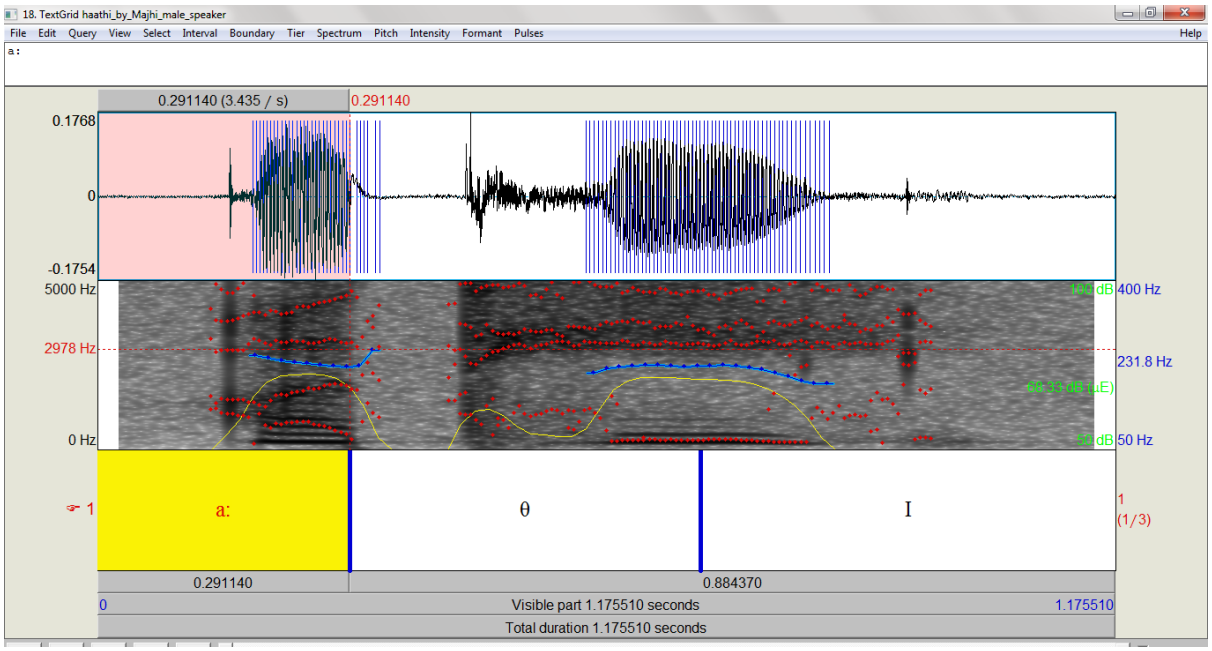
In all positions, glottal fricative merges with the neighboring vowel. So the present study views that, really, /h/ is glottal fricative or glottal approximant in nature. As mentioned above, according to Ladefoged (1982) and Roach (1983), /h/ is not a fricative but it is an approximant. Because of this reason, /h/ should be placed as approximant in IPA. It can be said that /h/ losses its features just because of following or fronting vowels.

RESULTS AND DISCUSSION

Acoustic analysis of Glottal Fricative

Glottal Fricative /h/ at Initial Position



Spectrogram of word “haathi” (elephant) by male speaker of Majhi dialect

This graph shows how glottal fricative /h/ at words initial position such as in the word “haathi” /ha:θɪ/ (elephant) is produced by male speaker of Majhi dialect. This figure shows that speakers of Majhi dialect do not pronounce “h” sound when they are speaking in their Punjabi dialect and glottal fricative /h/ merges with the preceding long vowel /a:/.

Glottal Fricative /h/ at Middle Position

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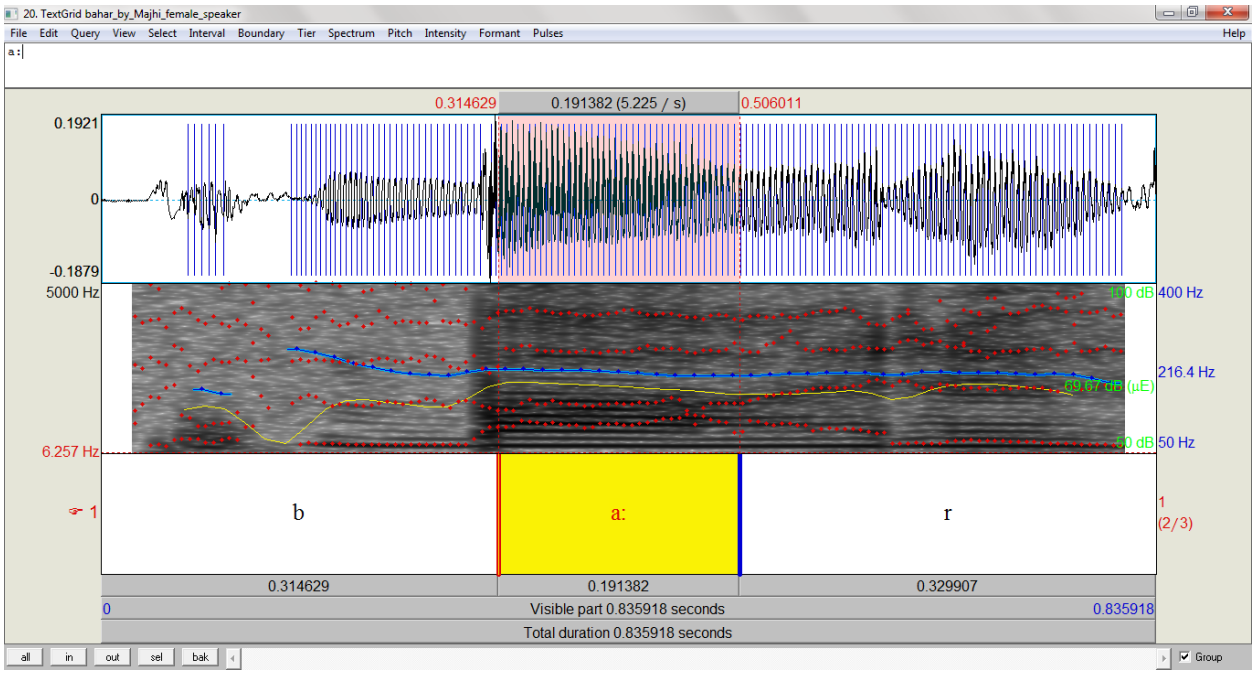

Spectrogram of word “bahaar” (springtime) by female speaker of Majhi dialect

This graph shows how glottal fricative /h/ at words middle position such as in the word “bahaar” /bəha:r/ (springtime) is produced by female speaker of Majhi dialect. This figure shows that /h/ sound changes its features because of the proceeding vowel /a:/.

Glottal Fricative at /h/ Final Position

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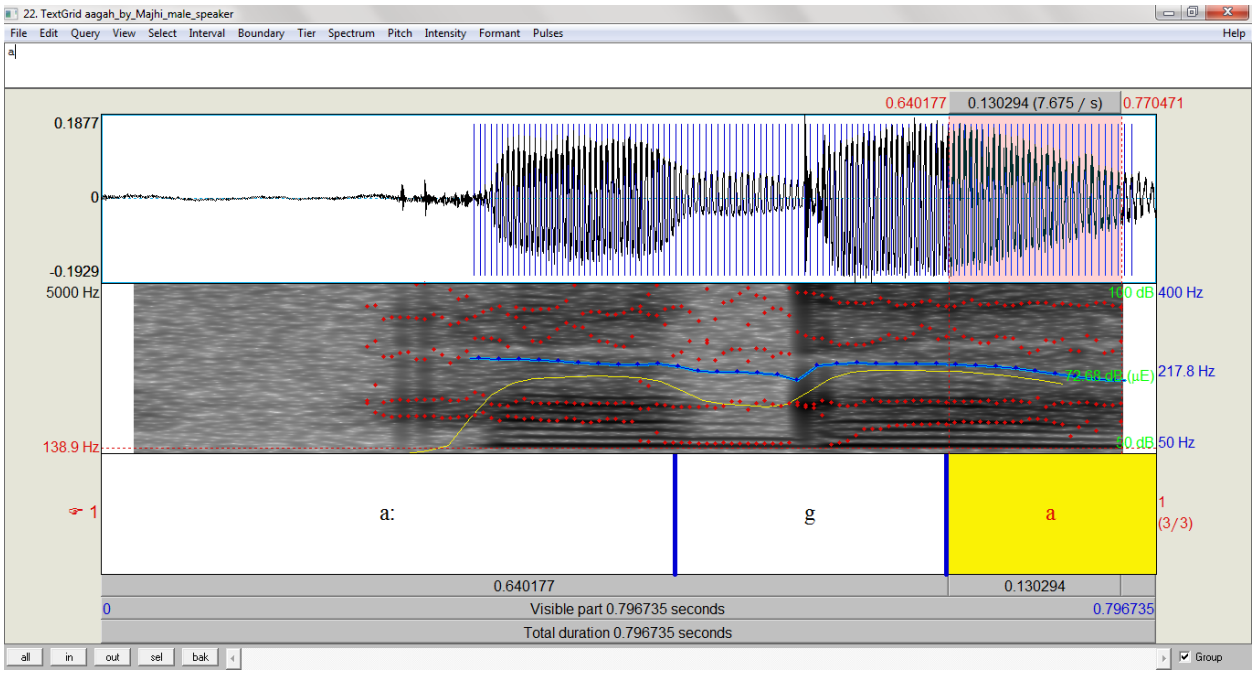

Spectrogram of word “aagah” (aware) by male speaker of Majhi dialect

This graph shows how glottal fricative /h/ at words final position such as in the word “aagah” /a:ga:h/ (aware) is produced by male speaker of Majhi dialect.

Analysis of Spectrograms

The above mentioned spectrograms show that how the words “haathi” (elephant), “bahaar” (springtime) and “aagah” (aware) are produced by male and female speakers of Majhi dialect. The main focus is on the glottal fricative /h/ that how it is produced by Majhi speakers and it is the most important sound of IPA chart. By looking this graph, it is clearly visible that /h/ is produced like its neighboring vowels such as in the first and second graph /h/ is merging with following and preceding longer vowel /a:/ respectively and in the third graph it is merging with shorter vowel /a/. /h/ has different features as compare to other fricatives in the above mentioned graphs. /h/ is voiceless when it comes at words initial position and vice versa. It is different from other fricatives because of its formants, irregular noise pattern and all these features are very much similar to its neighboring vowels. The formants of /h/ are merging with its adjacent vowels and due to this reason it is unable to separate from these vowels.

The formants are weaker than other fricatives. In the first spectrogram, formants of /h/ are moving from high to low because /h/ is at initial position while in the second graph, the formants remain in the same position and in the third graph, f1 is low to high and f3 is vice versa while f2 remains on the same position. The major difference is due to the rise and fall of f2 on irregular pattern. The

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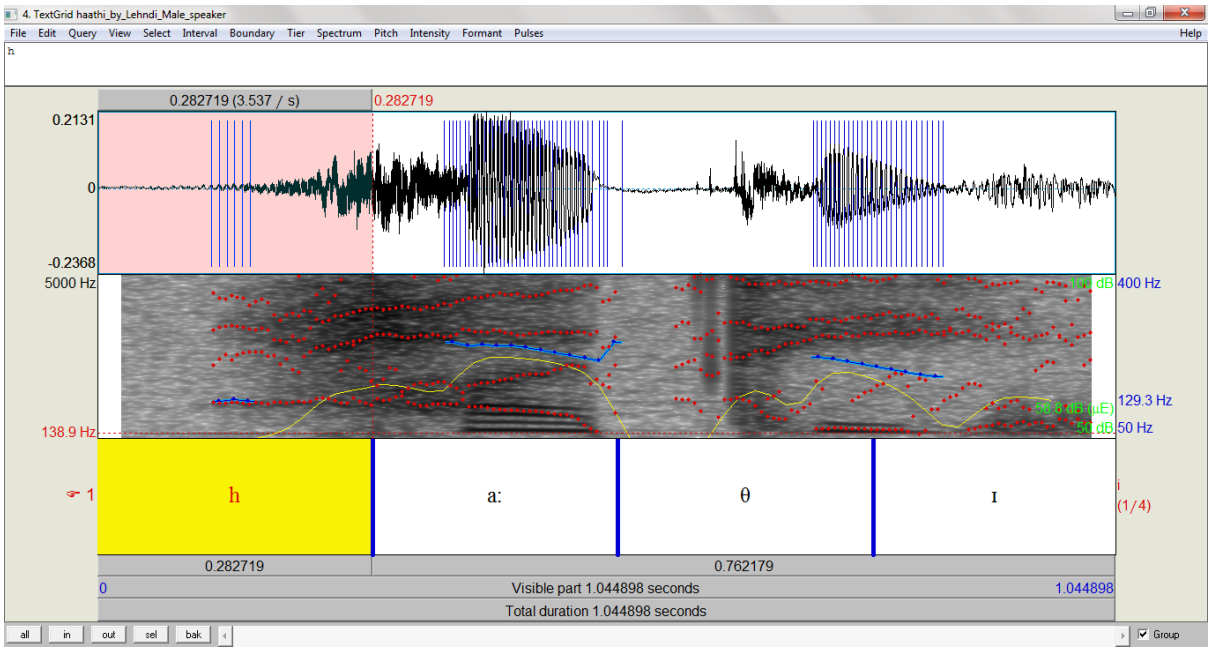
voicing bars are not dark like other fricatives. With the help of pitch contour and bars it is said that /h/ is voiceless in its initial and final positions while it is voiced in middle position. All these characteristics gives the answer of first research question and make visible that /h/ is not a glottal fricative but it is a glottal approximant in Majhi dialect.

Comparison between Majhi and Lehndi dialect

In order to get the answer of second research question, Majhi dialect has been compared to Lehndi dialect.



Spectrogram of word “haathi” (elephant) by male speaker of Lehndi dialect

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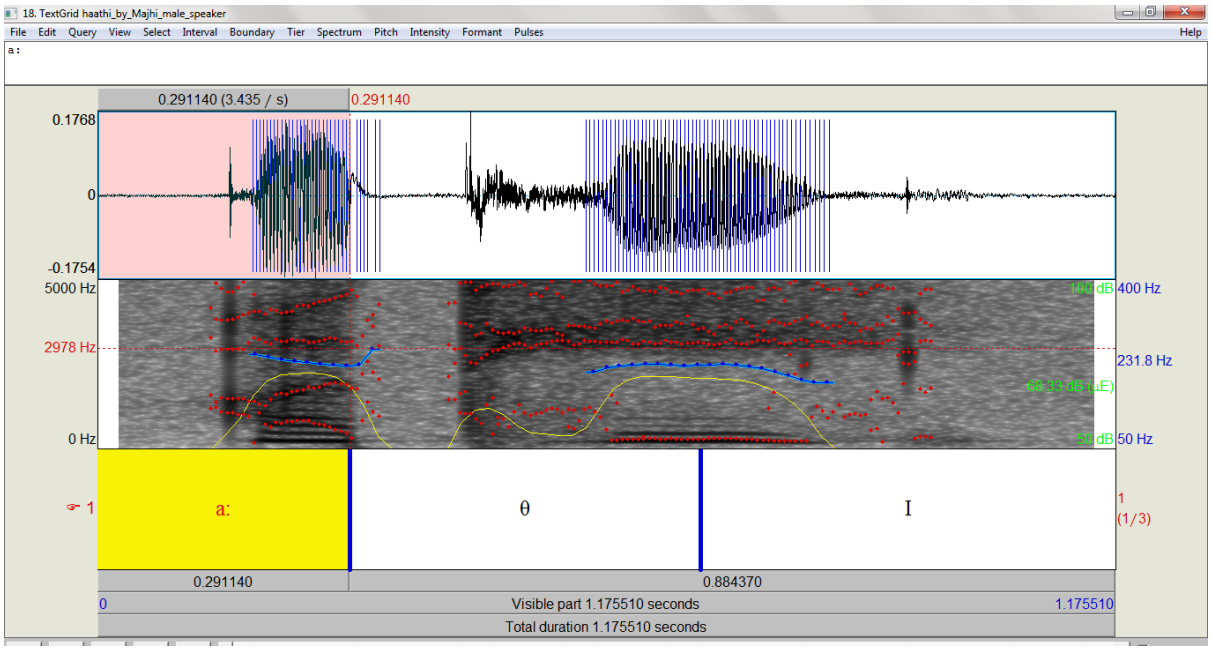

Spectrogram of word "haathi" (elephant) by male speaker of Majhi dialect

Comparative Analysis of Spectrograms

This graph shows how glottal fricative /h/ at words initial position such as in the word "haathi" /ha:θɪ/ (elephant) is produced by male speaker of Lehndi dialect. The voice bar of /h/ is not very dark in Lehndi as compare to Majhi. In Lehndi, the dark lines of /h/ are extending from one position to the other but there is omission of /h/ in Majhi. The formants of /h/ are very clear from its neighboring vowels that reveal that the speakers of Lehndi speak /h/ at words initial position but Majhi speakers do not. In Lehndi, the strongest formant is the F1 which is near 1000 Hz. F1 and F2 are more visible than F3 but in Majhi dialect /h/ is totally merged with /a:/. Moreover, there is irregular pattern of glottal fricative in the first mentioned spectrogram. Thorough the diagram, the pitch contour can be seen. All these features make sure that /h/ is voiced in Lehndi dialect at initial position. All of the formants are rising from lower to higher position. The duration of Lehndi glottal fricative is less than Majhi. But the energy of /h/ is not strong in Lehndi as compare to Majhi. The glottal fricative /h/ of Lehndi dialect has similar features of Majhi dialect at words middle and final positions. It means the speakers of Lehndi speak /h/ only at words initial position but not at words middle and final positions. That's why, the spectrograms of Lehndi glottal fricative at middle and final positions are very much alike Majhi spectrograms. In order to give the visual information, below is the comparative statistical analysis of Lehndi glottal fricative at words initial position.

Statistical Analysis of Glottal Fricative /h/

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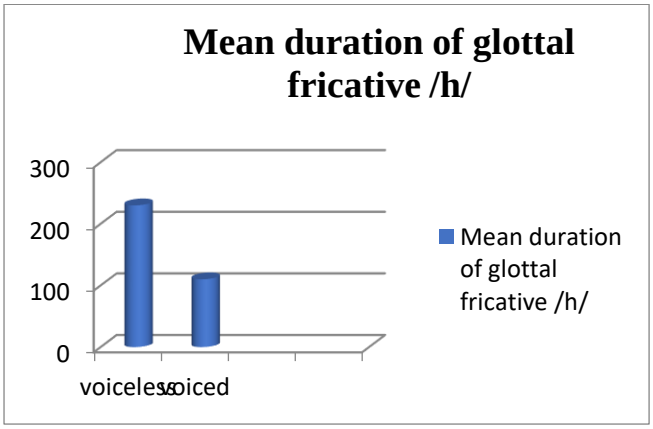
Mean Duration of glottal fricative /h/

With the help of SPSS, data was analysed by using the methods of mean score and standard deviation. Below is the table of mean scores of glottal fricative.

Mean Scores of Glottal Fricative /h/

Positions of Glottal fricative	Tokens	Voicing	Mean	Standard Deviation
Initial	60	Voiceless	230	0.0327
Middle	60	Voiced	110	0.0281
Final	60	Voiceless	250	0.0339

The above table shows the highest mean score at final position. This highlights when glottal fricative comes at words final position then there are more chances for glottal fricative to become like a glottal approximant as compare to initial position while on the other hand there are somehow less chances for a glottal fricative to become a glottal approximant. But this is very much clear from this table that there are no chances, in Majhi dialect, for glottal fricative to remain glottal fricative in all positions. Below is the chart that highlights that voiceless glottal fricative has more features of approximant as compare to voiced glottal fricative.



Changes in Mean because of Participant's Age

Mean Scores of Participant's age

Age	Position of glottal fricative	Mean	Standard Deviation

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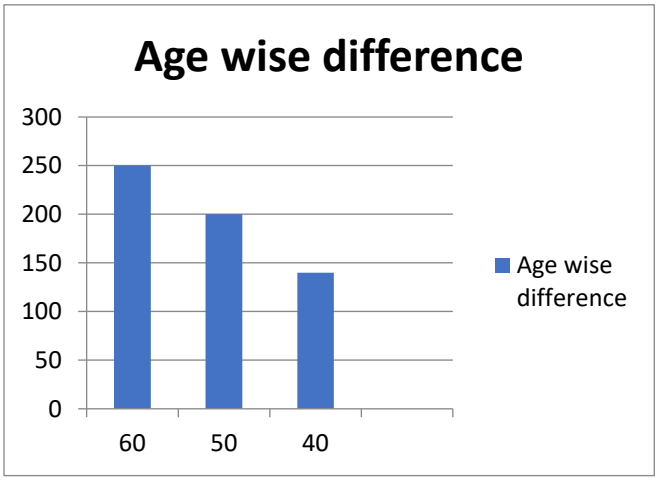
60 years	Initial/Middle/Final	250	0.0189
50 years	Initial/Middle/Final	200	0.2273
40 years	Initial/Middle/Final	140	0.2985

From the above table, it is evident that people who are near 60 years of age omit /h/ sound more as compare to those who are less than 60 in all positions. As age increases, the rate of omission of /h/ increases. With the help of mean and standard deviation, the significant difference has been visually analysed. Below is the chart giving visual information about glottal fricatives.



Glottal fricative was also measured with the help of its formants.

Formants of glottal fricative /h/

F1 (mean)	Standard deviation	F2 (mean)	Standard deviation	F3 (mean)	Standard deviation
1200	1.7927	2800	0.8326	4500	0.5791

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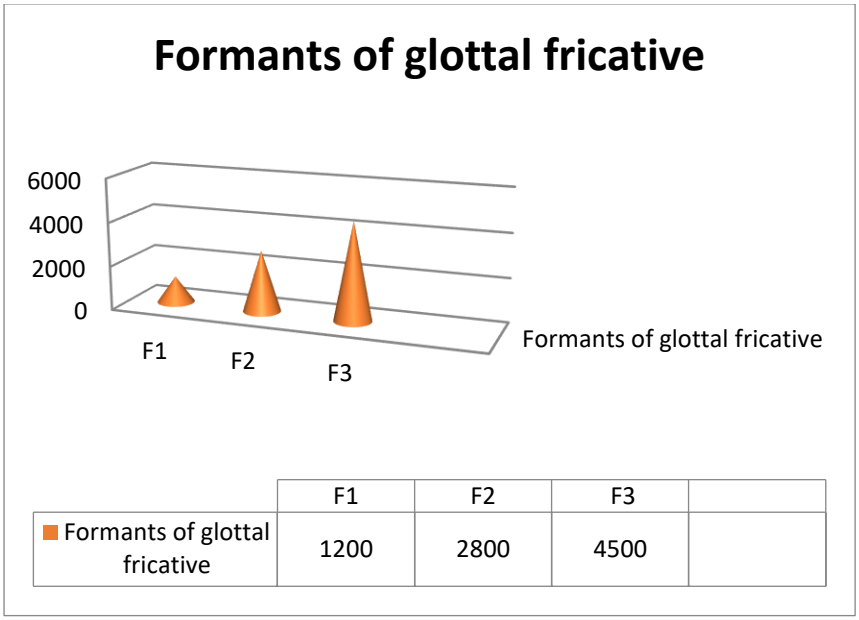

From the above analysis, it is clearly shown that the formants of glottal fricative range from 1200 to 4500. The patterns of formants show that the values of F1 are more similar to the neighboring vowels of glottal fricative. It means on the basis of F1, it is difficult to detach the glottal fricative from its adjacent vowels. F1 is low as compare to other formants which gives a clue that glottal fricative is actually a glottal approximant. While the F2 shows the position of tongue and also giving the characteristics like vowels. F3 is very high as compare to F1 and F2 and it reveals that although there is low and rise of formant but overall the mean score of F3 is high. Although, in English /h/ is voiceless but in Majhi dialect it is voiced as well as voiceless in nature and voiced glottal fricative has longer duration as compare to voiceless. The vowels which come before this fricative take less duration as compare to proceeding vowels. Glottal fricative turns into /a:/ because of same features.

Mean Duration of glottal fricative /h/ in Majhi and Lehndi dialect

Dialect	Positions of Glottal fricative	Mean	Standard Deviation
Majhi	Initial	230	0.0327
Lehndi	Initial	180	0.7821

From the above given table, it is noticeable that the glottal fricative /h/ can be spoken differently in each dialect from the other on the basis of duration. The mean duration of Majhi dialect of glottal fricative at words initial position is higher as compare to the mean dialect of Lehndi dialect. The visual representation of the mean of both fricatives has been presented below.

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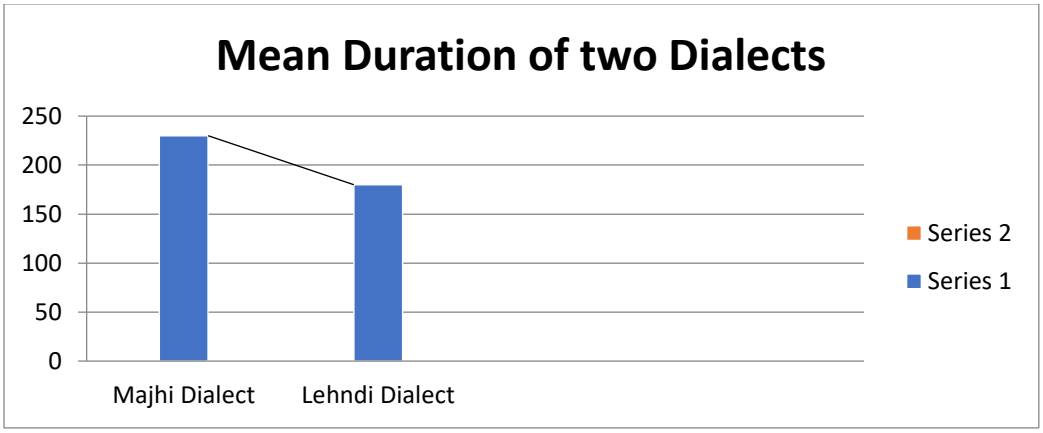
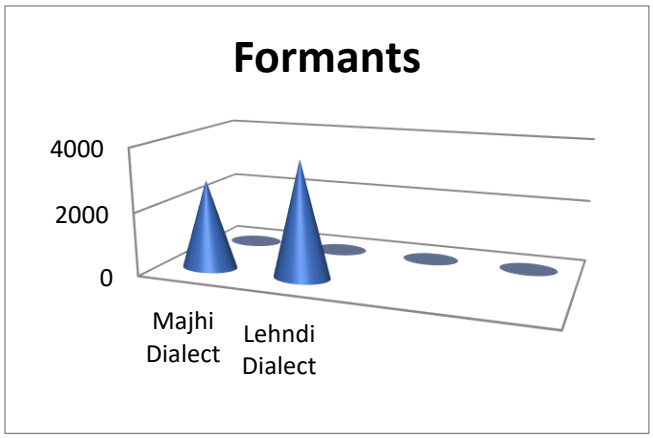


Formants of glottal fricative /h/ in Majhi and Lehndi Dialects

Dialect	Positions of Glottal fricative	Formants (Mean)	Standard Deviation
Majhi	Initial	2833	0.5215
Lehndi	Initial	3692	0.7821

The position of formants is very important clue to distinguish Majhi dialect from Lehndi dialect. The formants of Lehndi dialect are slightly higher than Majhi. The difference has been seen only on initial level because Majhi dialect is spoken differently from Lehndi only at words initial position. With the help of chart, the explained information is given below.



Effect of Gender on Formants

Majhi Female (mean)	**Majhi Male (mean)**	**Lehndi Female (mean)**	**Lehndi Male (mean)**

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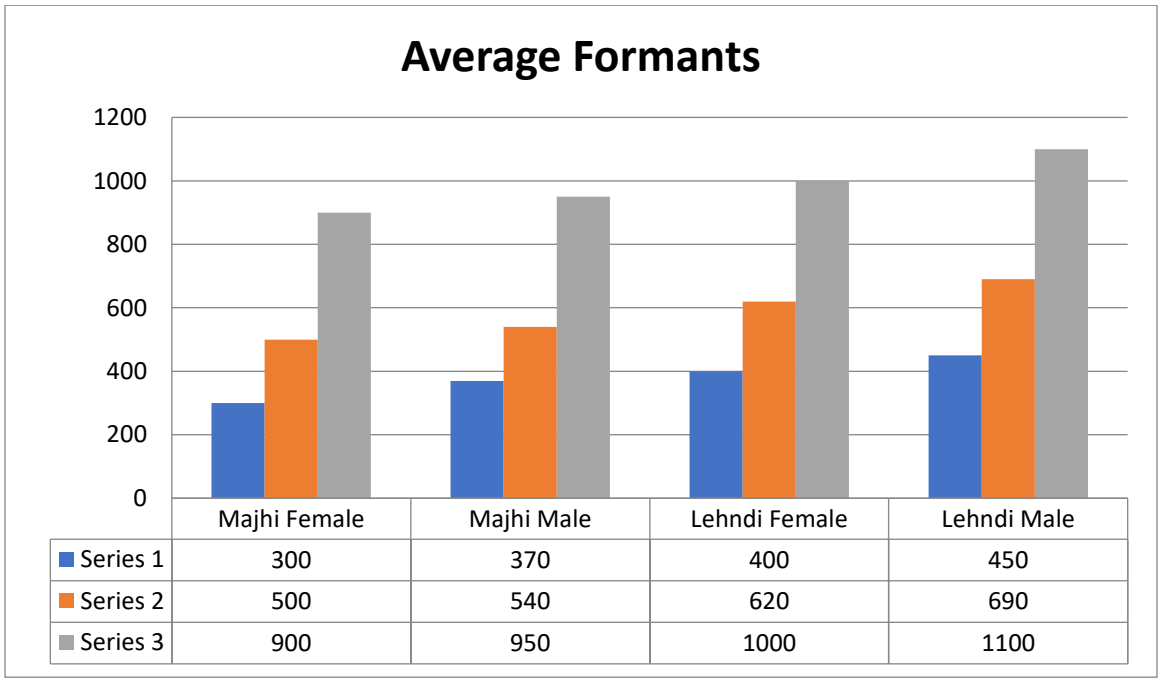
F1	**300**	**370**	**400**	**450**
F2	**500**	**540**	**620**	**690**
F3	**900**	**950**	**1000**	**1100**

In order to make the study a sociolinguistic study, the researcher has examined the values of formants according to the gender of participants. From the above table, it can be observed that the females speaker of Majhi dialect have very low values of F1, F2 and F3 as compare to their male partners at words initial position. The same situation is observed in the Lehndi dialect also. However, the values of F3 are greater than F2 and the values of F2 are greater than F1 in both dialects. The formant value of F1 is very low of Majhi females and F3 is very high of Lehndi male speaker. The graphic version has been presented below.



This study is limited to the glottal fricative of Majhi dialect and focuses upon the differences between Majhi and Lehndi dialect. The data has been taken by those participants who are above the age of forty years. The present work focuses on how glottal fricative is dropped by participants at words different positions and as a result, the formants gives characteristics like its neighboring vowels. So, it is recommended that the future researchers can work more on glottal fricative by comparing different dialects in order to hundred sure about its glottal or approximant nature. The sample size may be based on educated and educated participants.

CONCLUSION

This study explored the nature of glottal fricative /h/ in Majhi dialect and further consonant /h/ has been compared with Lehndi dialect in order to check the differences between both dialects. The data was gathered from twenty participants whose ages ranged from 40 to 60 years. This study concluded that the male and female speakers of Majhi dialect omit /h/ at words initial, middle and final positions. It means when they speak a word containing /h/, they merged it with the proceeding and preceding vowels of glottal fricative. That's why result shows that when glottal fricative is merged with its following or former vowel then it becomes a glottal approximant. The results of this study are similar with the study of Ladefoged (1982) and Roach (1983). The study also revealed that Lehndi dialect is different from Majhi because in Lehndi there is omission of /h/ at words middle and final position only.

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