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## **A Comparative Study of Formant Structures of Vowels in Kashmiri and Urdu**

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### **Abstract**

The paper reports the results of a comparative acoustic analysis of vowels in Kashmiri and Urdu language spoken by native Kashmiri speakers. The study involved a comparison of formant frequencies and duration of six vowels of Kashmiri and Urdu spoken by native Kashmiris. Forty native Kashmiri speakers, with twenty of them having Urdu as their second language contributed to the study. For all the six vowels in each language, average values for F1 were plotted against F2 values separately and then comparatively across the two languages. The results obtained have been tabulated and comparative graphs have been plotted to show the significant differences between vowels in the two languages. The data has been analyzed with PRAAT. Gold Wave software has been used for sound editing. Based on formant values of different vowels in the two languages, vowel spaces for the two languages have also been developed.

**Keywords:** *Kashmiri, Urdu, Vowel, Formant analysis, Spectrograph.*

### **1. Introduction**

Vowels are pulmonic pressure sounds normally voiced, with a maintainable central oral approximant or dorso-domal, or pharyngeal, articulatory channel (Catford, 1988:123). Articulatory parameters of distinguishing vowels are front-back, rounded-unrounded, and high-low. Vowels are distinguished on the basis of the nature of resonance set in motion by vocal fold vibration. These resonances of the vowel tract are commonly called the Formants of the vocal tract and these formants play a crucial role in the determination of the vowel sounds (Catford, 1988:126).

Vowels have a number of formants which are always higher than the fundamental frequency and are numbered as F1, F2, F3, and so on. There exists a difference between the fundamental frequency (F0) and the formants of the vowels. Whereas Fundamental Frequency is essentially determined by the rate of the vocal cord vibrations in seconds, formants on the other hand, are dependent on the overall shape and size of the cavities above the larynx. (Catford, 1988:160).

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The different vowel qualities are realized in acoustic analysis of vowels by the relative values of the formant, acoustic resonances of the vowel tract which show up as dark bands on a spectrogram. The vocal tract acts as a resonant cavity, and the position of jaws, lips, and tongue affect the parameters of the resonant cavity, resulting in different formant values. The acoustics of vowels can be visualized using spectrograms, which display the acoustic energy at each frequency, and how this changes with time (Ladefoged, 1993).

Pointing out the relation between the articulation of the vowels and their respective formant patterns, Ladefoged (1962:104) maintains that from the point of view of articulation, the amount of constriction in the pharyngeal-oral cavities and the lip-position (i.e., rounded/unrounded), the vowel height (i.e. the relationship between the highest point of tongue and the roof of the oral cavity) and vowel location (i.e. the point of the tongue which is the most raised during the time of the vowel articulation) play a crucial role in the determination of the formants of the vowels.

While referring to concepts like ‘vowel space’ and ‘vowel limit’, Catford (1988:130-135), reports that the idea of the cardinal vowels proposed by Jones (1964) is based on the concept that the vowels are limited by vowel space/limit. In the production of a vowel, there is a certain fixed area/space within oral-pharyngeal cavity, beyond which the vowel takes space of an approximate type sound. Thus, vowel of any language must have its tongue-position either on the vowel limit itself, or within the vowel space.

According to Ladefoged (1993), the first formant (F1), refers vowel openness (vowel height). Open vowels have high frequencies while close vowels have low F1 frequencies. The second formant (F2), corresponds to vowel frontness. Back vowels have low F2 frequencies while front vowels have high frequencies.

Duration of the vowel is the time taken by the speaker to articulate a vowel. Vowel duration plays an important role in distinguishing segments. Variation in length can be allophonic or phonemic. (Crystal, 1996:171)

## **2. The Present Study**

Kashmiri and Urdu are the two widely spoken languages in J&K Union Territory of India. While Kashmiri is the native language of around six million people of Kashmir and Pir Panchal region of Jammu division, Urdu is the official language of Union Territory. It serves as lingua franca for the people of diverse linguistic backgrounds. Even though Urdu is being gradually replaced by English in official domains like schools and colleges, courts and other institutions of governance, the language still holds prestige among the people of the union territory and continues to serve the function of link language between people of diverse linguistic backgrounds.

The variety of Urdu spoken in Kashmir is highly influenced by Kashmiri and interference can be found at all structural levels like Phonology, Morphology and in Syntax.

The paper aims at finding the differences between three long and short vowels of Kashmiri and Urdu as spoken by native Kashmiri speaker:

/i/ - high front

/u/ - back high rounded

/a/ - low central

In both the languages, the three vowels represent the limits in the vowel space as these fall on the margins of the vowel space; high front/i/ vowel falling at the high front/close extreme, the high back rounded /u/ lying at back/close extreme and low central /a/ lying on the open extreme. The comparison includes six vowels in total; three short and their three longer counterparts.

In the present study, the basis of comparison is the spectrographic features; the six vowels have been compared with regard to F1 and F2. The duration of the vowels has also been calculated and compared.

### **3. Methodology**

The analysis of vowel sounds in terms of their frequencies has been made easier through various softwares such as PRAAT and Gold wave. PRAAT is software for analysis and synthesis of speech. PRAAT has a variety of features which include the facility to analyze and synthesize speech in terms of waveform, fundamental frequency, constituent formants and spectrographic analysis. Goldwave is a digital audio editing software with various graphic visuals including spectrogram and spectrum.

For the purpose of the study, forty native speakers of Kashmiri language having Urdu as a second language were randomly selected. All the informants for the study were young adults enrolled in various Postgraduate programs in Kashmir University. All these informants belong to J&K Union Territory, with their ages ranging between 20-30 years.

Two set of word list were prepared in Kashmiri and Urdu containing the six vowels (three short, three long). The first list comprised of Kashmiri words having the six vowels in the word medial position. The second list comprised of Urdu words with the six vowels in the word medial position. The comparison has been made with regard to the six vowels occurring in word-medial positions only.

The informants were requested to read out the list of words in a natural way. The informants were asked to pronounce each word thrice. The data was recorded in sound proof recording room.

### **4. Results**

#### **4.1 Kashmiri Short Vowels**

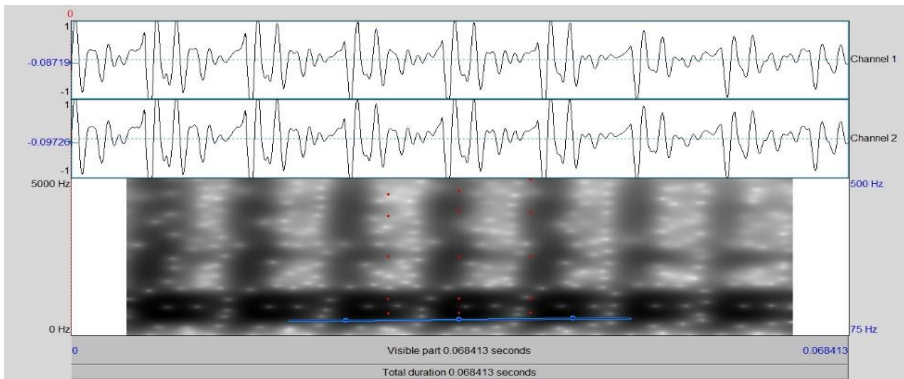
The mean of F1 and F2 of three short vowels of Kashmiri and Urdu are tabulated below for comparative purposes:

Vowels	F1(Avg)	F2(Avg)	Duration
/a/	826.17 Hz	1335.50 Hz	0.068 sec
/i/	432.05 Hz	2910.48 Hz	0.091 sec
/u/	316.27 Hz	1695.10 Hz	0.089 sec

Table 1. Shows average formant values and average duration of Short Vowels in Kashmiri

#### 4.1.1 Vowel /a/

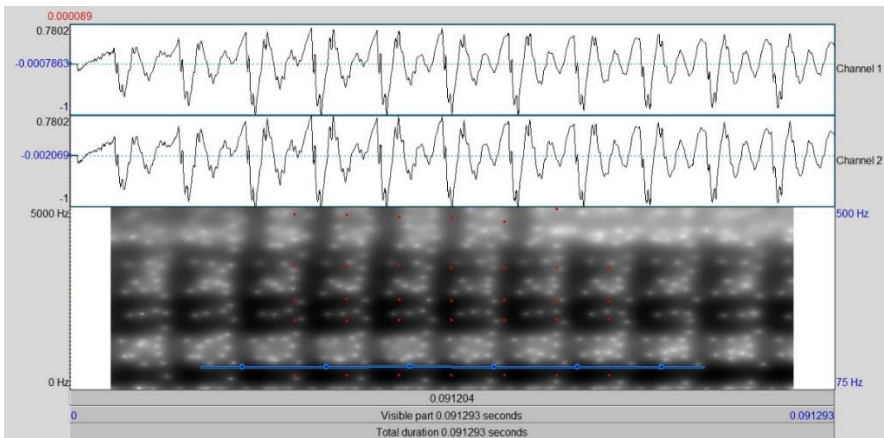
The spectrogram of Kashmiri short vowel /a/ is shown in Fig.1



**Fig. 1**

#### 4.1.2 Vowel /i/

The spectrogram of Kashmiri short vowel /i/ is shown in Fig.2



**Fig 2.**

#### 4.1.3 Vowel /u/

The spectrogram for Kashmiri short vowel /u/ is shown in Fig 3.

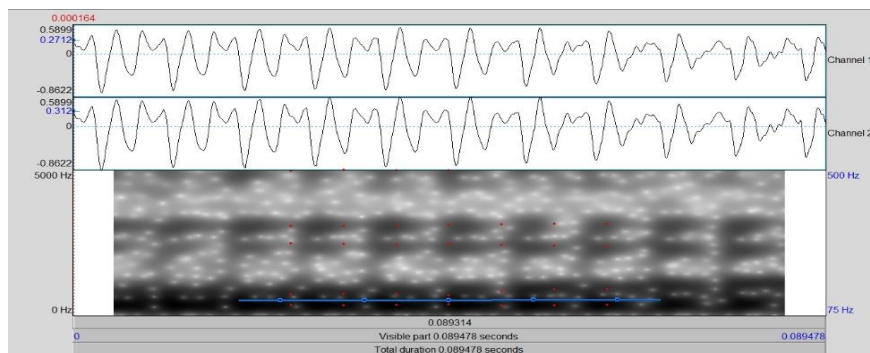
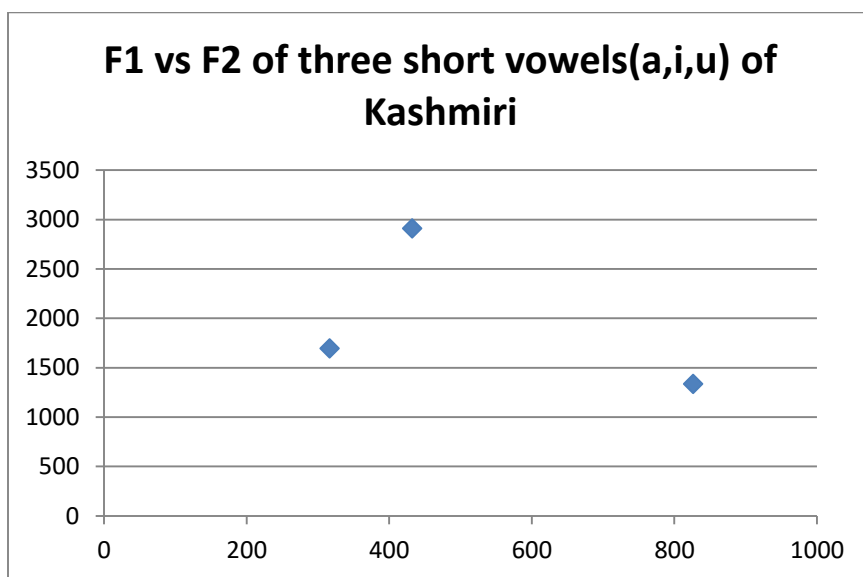


Fig 3.

#### 4.1.4 Acoustic space of three short vowels of Kashmiri:



Graph 1. Shows the average values of three short vowels of Kashmiri.

#### 4.1.5 Average formant values and average duration of Long Vowels in Kashmiri

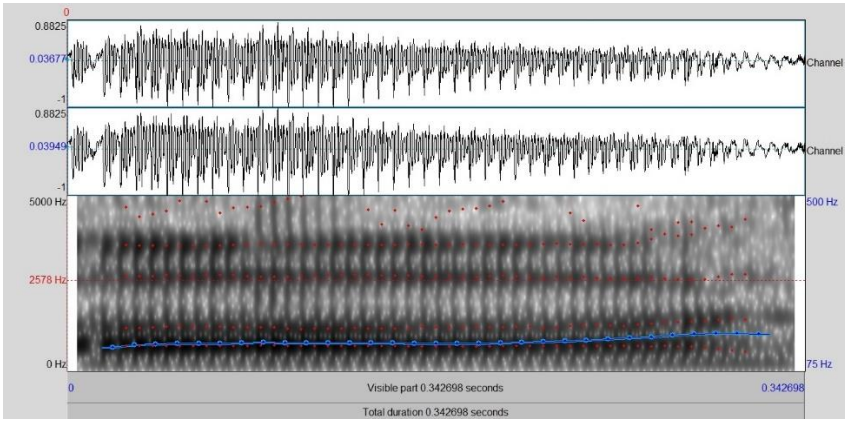
Vowels	F1(Avg)	F2(Avg)	Duration
/a:/	822.37 Hz	1340.47 Hz	0.34 sec
/i:/	367.53 Hz	2148.92 Hz	0.32 sec
/u:/	427.81 Hz	1503.09 Hz	0.31 sec

Table 2.

## 4.2. Longs Vowels in Kashmiri

### 4.2.1 Vowel /a:/

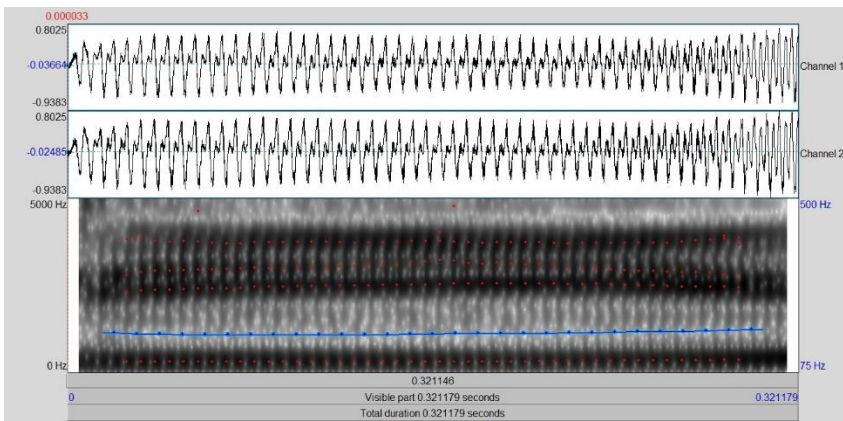
The spectrogram of Kashmiri long vowel /a:/ is shown in Fig 4.



**Fig 4.**

### 4.2.2 Vowel /i:/

The spectrogram of Kashmiri long vowel /i:/ is shown in Fig.5



**Fig 5.**

### 4.2.3 Vowel /u:/

The spectrogram of Kashmiri long vowel /u:/ is shown in Fig 6.

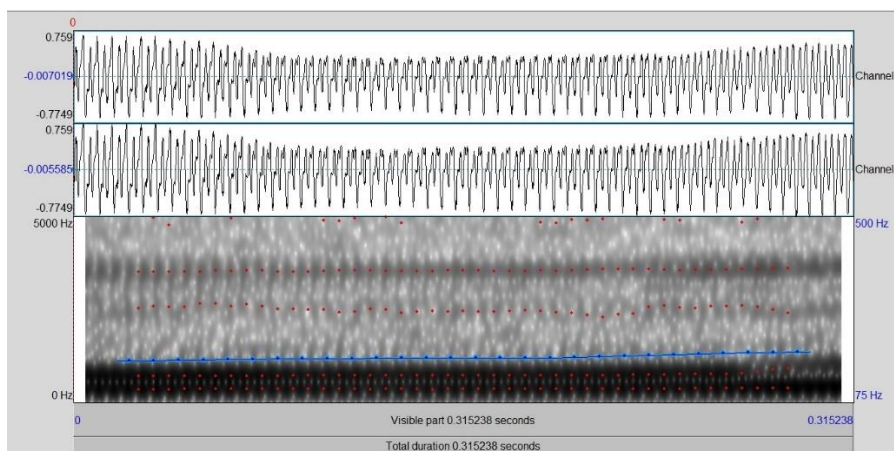
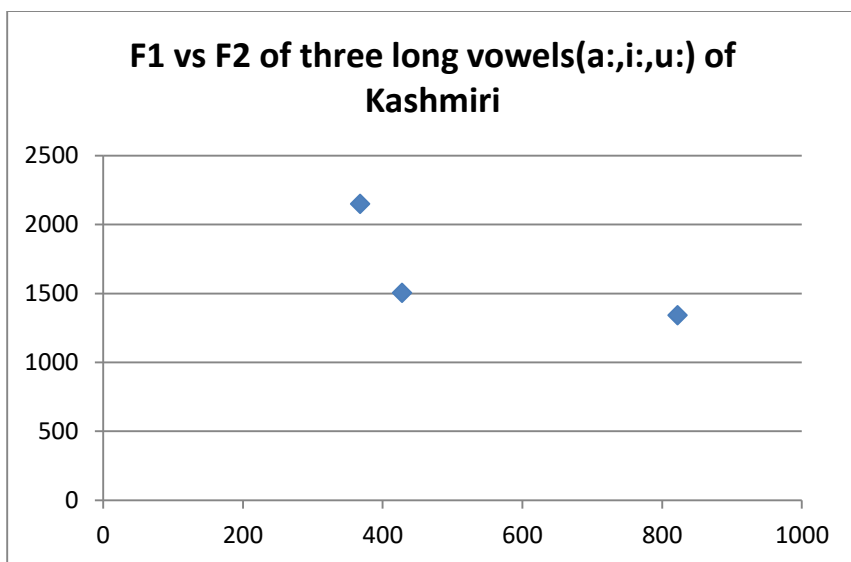


Fig 6.

### 4.2.4 Acoustic space of three long vowels of Kashmiri:



Graph 2. Shows the average values of three long vowels of Kashmiri.

### 4.3 Urdu short Vowels

4.3.1 Average Formant values of Urdu short vowels is shown in Table 3.

Vowels	F1(Avg)	F2(Avg)	Duration
/a/	720.43 Hz	1270.20 Hz	0.069 sec
/i/	410.94 Hz	2730.38 Hz	0.089 sec
/u/	305.58 Hz	1577.82 Hz	0.87 C

Table 3.

#### 4.3.2 Vowel /a/

Following is the spectrogram of Urdu short vowel /a/ in Fig 7.

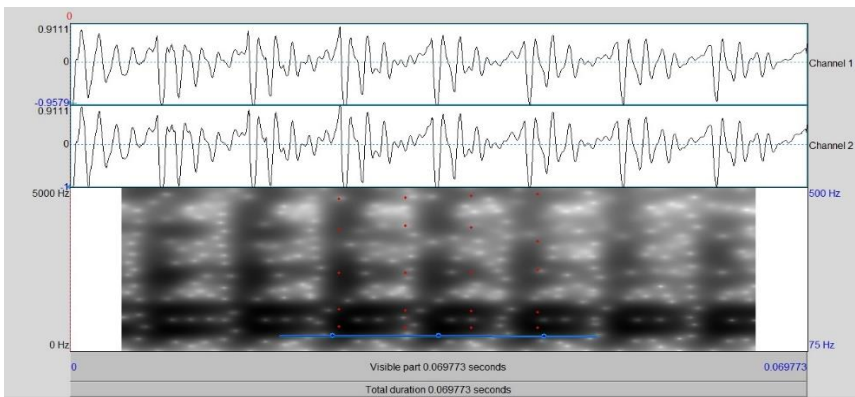


Fig 7.

#### 4.3.3 Vowel /i/

Following is the spectrogram of Urdu short vowel /i/ in Fig 8.

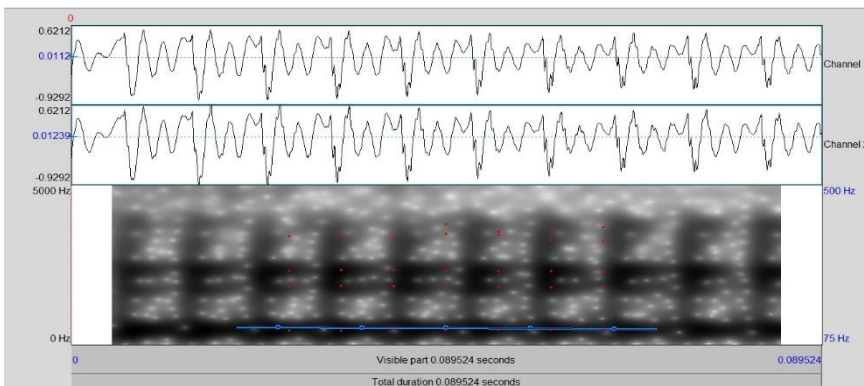


Fig 8.



#### 4.3.4 Vowel /u/

The spectrogram of Urdu short vowel /u/ is shown in Fig 9.

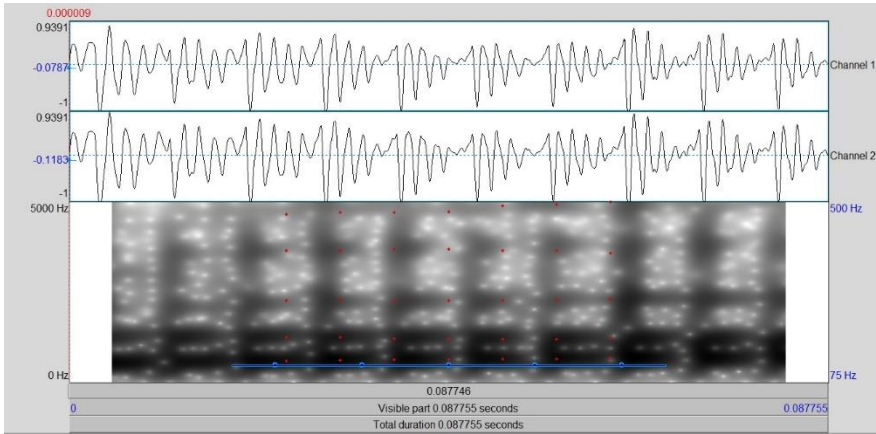
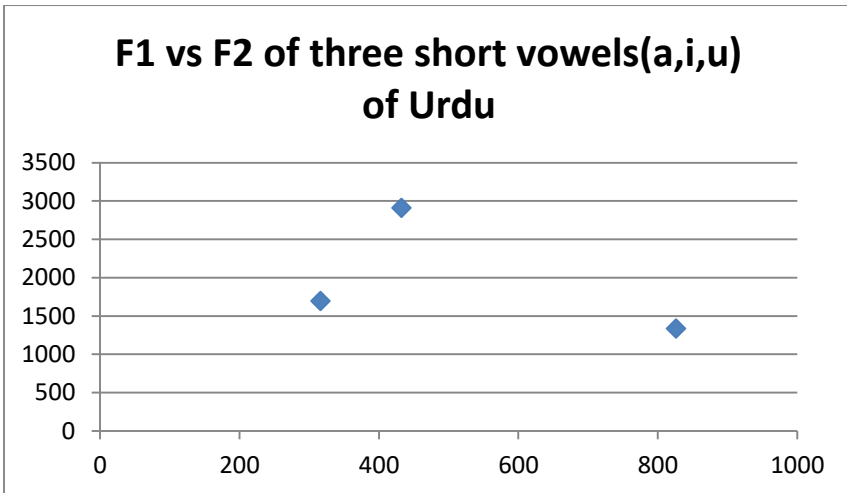


Fig 9.

#### 4.3.5 Acoustic space of three short vowels of Urdu:



Graph 3. Shows the average values of three short vowels of Urdu.

#### 4.4 Urdu long Vowels

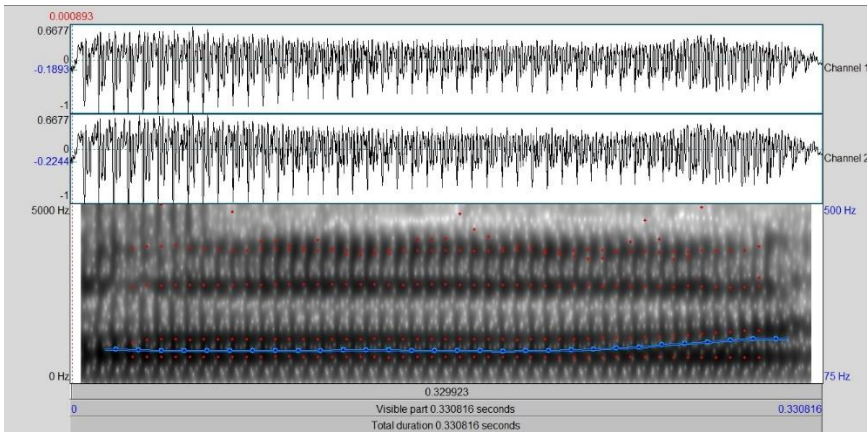
4.4.1 Average Formant values of Urdu long vowels is given in Table 4.

Vowels	F1(Avg)	F2(Avg)	Duration
/a:/	770.79 Hz	1298.47 Hz	0.33 sec
/i:/	349.47 Hz	2027.89 Hz	0.33 sec
/u:/	398.33 Hz	1325.41 Hz	0.30 sec

**Table 4.**

#### 4.4.2 Vowel /a:/

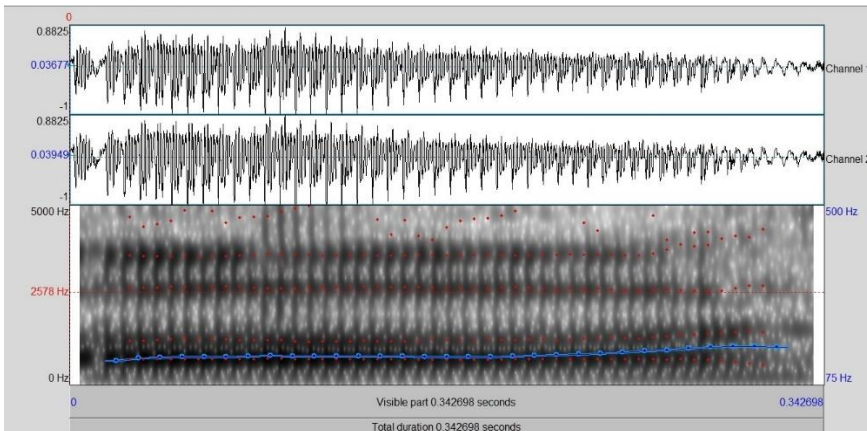
The spectrogram of Urdu long vowel /a:/ is shown in Fig 10.



**Fig 10.**

#### 4.4.3 Vowel /i:/

The spectrogram of Urdu long vowel /i:/ is shown in Fig 11.



**Fig 11.**

#### 4.4.4 Vowel /u:/

The spectrogram of Urdu long vowel /u:/ is shown in Fig 12.

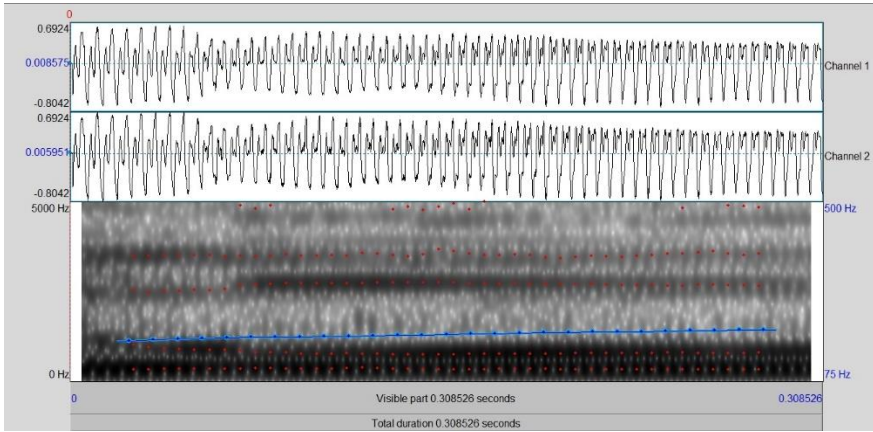
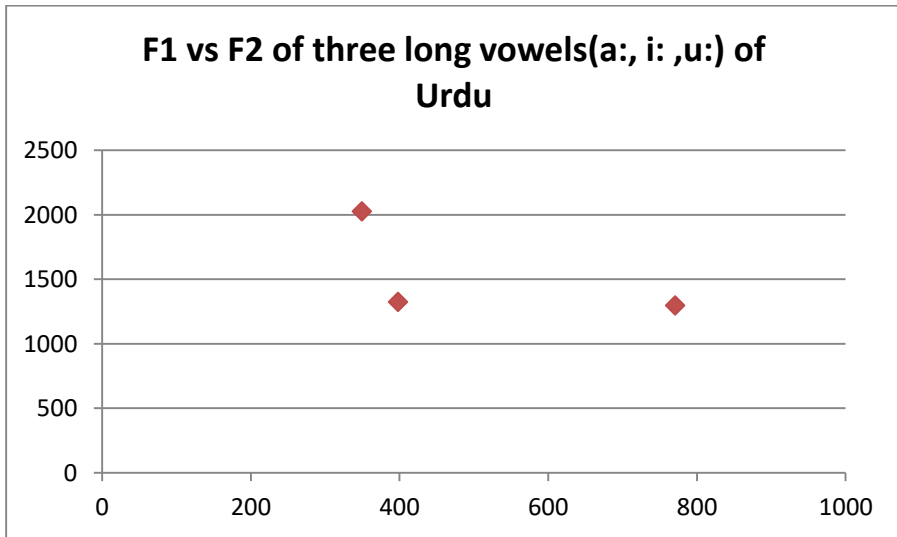


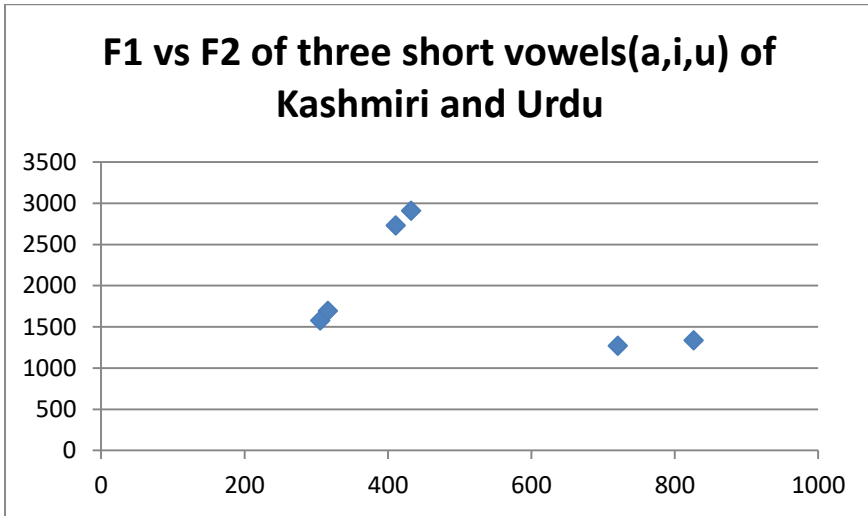
Fig 12.

#### 4.4.5 Acoustic space of three long vowels of Urdu



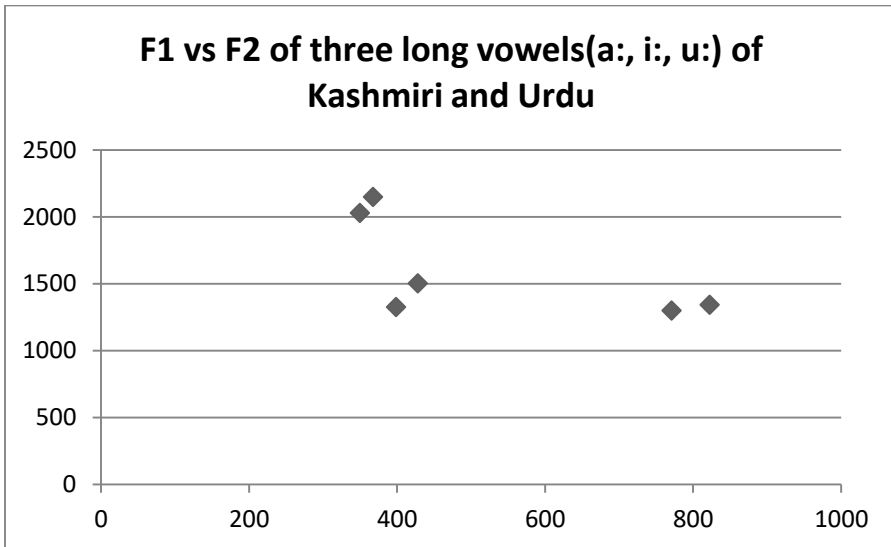
The above graph 4. shows the average values of three long vowels of Urdu.

**4.5 Acoustic space of three short vowels of Kashmiri and Urdu**



Graph 5. Shows the average values of three short vowels of Kashmiri and Urdu.

**4.6 Acoustic space of three long vowels of Kashmiri and Urdu:**



Graph 6. Shows the average values of three long vowels of Kashmiri and Urdu.

## 5. Conclusion

A comparison of the vowel duration of the two languages shows that there is not a significant difference between the vowels of the two languages. Vowel duration is almost same in both the languages. The average of the fundamental frequencies is lower in all Urdu vowels as compared to Kashmiri vowels. The average of F1 and F2 is higher in Kashmiri long and short vowels as compared to Urdu long and short vowels. The acoustic space appears to be practically the same in case of the vowels of Kashmiri and Urdu.

The acoustic analysis of speech sounds has significant implications for language teaching as well as applications of phonemic studies in different fields. Data from acoustic analysis would also be of great help in foreign language teaching programs and in understanding & explaining the difference between L1 & L2. Acoustic analysis of speech can thus prove to be a very important pedagogical aid that would increase the effectiveness of the language teachers and thereby increase the speed of learning for the students.

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