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An Acoustic Analysis of the Vowels of Lambada Language

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Abstract: ***The study aims at an acoustic description of the vowels of Lambada, a minor language with a special focus on the speakers of Telangana state. Lambada vowel inventory comprises of five short vowels \i,ɛ,a,o,u\, their longer counterparts \i:,ɛ:,a:,o:,u:\ and two diphthongs \ai, au\. An acoustic experiment has been conducted with five native male speakers of Lambada and the description builds on the observations made by Peter Ladefoged and Bruce Hayes (Dept; Linguistics UCLA). The study is restricted to only male speakers. Authors have chosen monosyllabic, disyllabic and polysyllabic Lambada words having monophthongs and diphthongs in order to find out the variations of formant frequency values of each vowel in various positions of a word. Hence, the frequency of first, second and third formants for each vowel were calculated and provided in the explanation of each vowel. The acoustic analysis of some vowels in Lambada language show that the formant values are approximately close to the formant values of English vowels. The analysis was done making use of Praat Software, which has been highly and widely accepted and followed in the field of Phonetics for years.***

Keywords: Vowels – Lambada language – Acoustics – Fundamental frequency

1. Introduction

Vowels are sounds in which there is no obstruction to the flow of air as it passes from the larynx to the lips. We need to know in what ways vowels differ from each other. The first matter to consider is the shape and position of the tongue. It is usual to simplify the very complex possibilities by describing just two things: firstly, the vertical distance between the upper surface of the tongue and the palate and, secondly, the part of the tongue, between front and back, which is raised highest. It is difficult to estimate how many vowel sounds there are in the world‘s languages. Languages differ greatly in the number of vowels that they use. About 20 percent of the world‘s languages have five contrasting vowels **a, e, i, o, u,** (Ladefoged, 2001:25). The most common vowel in nearly all languages is **a**, and the least common vowel in languages with five vowels is usually **u**, with the other vowels falling in between in frequency. The vowels of English differ in what is usually called vowel height and vowel backness and also differ in lip rounding. We all know what a vowel sounds like, but there are no popular terms for describing how the quality of vowel differs from that of another. We need to consider the acoustic properties we have been considering so far, the frequency (pitch) and intensity (loudness) of different sounds. Vowels can be produced on any pitch within the range of a speaker‘s voice. In order to represent the vowels of a language we need to show the average values of the formants. The most useful representation of the vowels of a language is a plot showing the average values of formant one and formant two for each vowel as spoken by a group of speakers.

2. Acoustic Analysis of Lambada Vowels

Lambada language does not have a script and they fall back on Telugu script for written mode of communication. Eleven vowel phonemes of Lambada language have been identified in the study. The vowels have been described in detail.

3. Aim of the study

The study aims at an acoustic description of the vowels of Lambada, a minor language with a special focus on the speakers of Telangana state.

4. Choice of the Informants

An acoustic experiment has been conducted with the five native male speakers of Lambada. The study is restricted to only male speakers.

5. Methodology

Recorded speech samples of all the informants are played back on the computer and were transcribed phonemically according to the auditory impressions of the authors. Praat software is used for the duration of the Lambada vowels and the description of the Lambada vowels builds on the observations made by Peter Ladefoged and Bruce Hayes (Dept; Linguistics UCLA).

6. Results and Discussion of Vowels in the Lambada Language

Lambada vowel inventory comprises of five short vowels /i,ɛ,a,o,u/, their longer counterparts /i:,ɛ:,a:,o:,u:/ and two diphthongs /ai, au/.

6.1. The vowel /i:/

The vowel /i:/ is a Front, High and Spread Vowel

Table 1: Distribution of the Vowel /i:/

Lambada words in English script	*Transcription of Lambada words*	*Gloss*
Eez	/i:z/	This
Beed	/bi:d/	forest
Kaldee	/ka:ldi:/	skin

The Lambada vowel /i:/ is similar to English long vowel /i:/ as in the words 'eat', 'seen', and 'read'. The lips are in neutral position or slightly spread during the pronunciation of this vowel. The tip of the tongue is placed on the inner side of the lower front teeth and front part of the tongue is raised towards the alveolar ridge. According to the position of the speech organs during the process of pronunciation of long vowel /i:/, may be defined as an unrounded, front, high vowel. It may vary from a short to an extra long vowel, depending on the emphasis and the manner of pronunciation. In casual pronunciation it is not as long as English vowel /i:/ but longer than English short vowel /i/. The first formant of the vowel is placed at 320 Hz, The second formant is situated around 2400 Hz, and third formant may vary around 3000 Hz. Average duration of this vowel is 139 milliseconds.

6.2. The vowel /i/

The vowel /i/ is a Front Close Unrounded Vowel**.**

Table 2: Distribution of the vowel /i/

Lambada Words in English Script	*Transcription of Lambada Words*	*Gloss*
Idhe	/idɛ/	This/That
Kidhi	/kidi/	Done
Aarsi	/a:rsi/	Mirror

The Lambada vowel /i/ is shorter than Lambada long vowel /i:/. The short vowel /i/ is more open than long vowel. It is not as open as English short vowel /i/ as pronounced in words like 'sit', 'city', 'kick' and 'baby'. In the pronunciation of short vowel /i/ the tip of the tongue is placed on the inner side of the front teeth and the front part of the tongue is raised towards the alveolar ridge of the roof of the mouth. The lips are in neutral position as for breathing through the mouth. Short Lambada vowel /i/ is front, high, unrounded vowel. The first formant of the Lambada short vowel /i/ is placed at about 310 Hz and going up 350 Hz. The second formant is situated at 2100 Hz and the third formant is placed at 3150 Hz. The duration of the vowel is 106 milliseconds. The main difference between /i/ and its longer counterpart /i:/ is that of length.

6.3. The vowel / ɛ/

The vowel **/ɛ/** is a Front, Half close and Unrounded Vowel.

Table 3: Distribution of the vowel /ɛ/

Lambada Words in English Script	*Transcription of Lambada Words*	*Gloss*
Evdi	/ɛʋdi/	This side
Kela	/kɛɬə/	Banana
Idhe	/idɛ/	This

This Lambada vowel **/ɛ/** is more open than English vowel /e/ as pronounced in words such as 'bed, get, met and set'. During the production of this vowel**,** the lips are in neutral position, and the opening depends on the jaw angle. The tip of the tongue is placed on the edge of the lower teeth; it is slightly curved in its front part, which is raised towards the front part of the teeth. The soft palate is raised, preventing passage of the air stream through the nasal cavities. The vocal cords are set in action and it is front vowel which covers the region from half-close to half-open positions the lips are loosely spread. The acoustic structure of the vowel shows the first formant evident at 410 Hz, the second formant is placed 2200, the third formant is situated around 2500 Hz. The average duration of vowel is 105 milliseconds.

6.4. The vowel / ɛ:/

The vowel /**ɛ**:/ is a Centralized Front, Nearly Half close Unrounded Vowel.

Table 4: Distribution of the vowel /ɛ:/

Lambada words in English script	*Transcription of Lambada words*	*Gloss*
Bes	/bɛ:s/	sitting
Keth	/kɛ:t/	field
Yeji	/jɛ:dʒi/	yet

The Lambada vowel **/ɛ:/** is a centralized front, nearly half close unrounded vowel. The Indian speakers have the habit of using **/ɛ:/** instead of English diphthong /ei/ when they pronounce words 'say', 'make', 'great', 'paper'. The long Lambada vowel /ɛ:/ shows the first formant at 416 Hz and the second formant is placed around 2380 Hz and the third formant is situated at 2650 Hz. The duration of this vowel is 191 milliseconds.

6.5. The vowel /a/

The vowel /a/ is a Central, open and Spread Vowel.

Table 5: Distribution of the vowel /a/

Lambada words in English script	*Transcription of Lambada words*	*Gloss*
Lakidee	/lakidi:/	stick
Kanduva	/kanduʋa/	towel
Acho	/atʃo/	good

Short central vowel /a/ is similar to English vowel /ʌ/ as pronounced in words such as 'cup', 'bud', and 'nut'. They have some similarity and the English vowel may serve as reference. There is reduction in quality when it is clustered with nasal sounds. The position of the lips is neutral during the production of this vowel and their opening depends on the jaw angle. The front part of the tip of the tongue and the mid part of it are in neutral position. The back part of it is pushed slightly backward in descending position. The acoustic structure of short central vowel /a/ displays larger dynamics in the first formant than long lambada vowel /a:/ it may fluctuate at 800 Hz , the second formant may be at 1600 Hz, and the

third formant is around 2650 Hz. Its duration is 102 milliseconds.

6.6. The vowel /a:/

The vowel /**a:**/ is a Open, Unrounded Half back Vowel.

Table 6: Distribution the vowel /a:/

Lambada words in English script	*Transcription of Lambada words*	*Gloss*
Aaj	/a:dʒ/	today
Paani	/pa:ni/	water
Baa	/ba:/	dad

The Lambada vowel/a:/ has great similarity with the English back long vowel, English back vowel is more back and more open than Lambada back vowel. The tip of the tongue is placed behind the ridge of the lower teeth, not pressing it. The front part of the tongue is slightly hollowed in its mid area and the middle part of the tongue is elevated to a slight degree towards the position of the back part of the tongue which is pulled back into a gently sloping position. Lambada vowel /a:/ is an open, unrounded half back vowel. The vowel is not centralized, and fully voiced. The length of the vowel depends on the stress, degree of emphasis, position in the word, contextual place and from person to person, the variability of the length of the vowel does not particularly affect the vowel quality. The structure of the long vowel /a:/ shows the first formant has a very stable position around 750 Hz, the second formant is placed around 1350 Hz and the third formant is placed around 3000 Hz. The duration of the vowel is 113 milliseconds.

6.7. The vowel /o/

The vowel **/o/** is a Back, High mid and Rounded vowel.

Table 7: Distribution the vowel /o/

Lambada words in English script	*Transcription of Lambada words*	*Gloss*
Tokno	/tokno/	Vessel
Kho	/kʰo/	eat
Sojo	/sodʒo/	sleep

It resembles the English short vowel /ɔ/ or/ɒ/, as in ‘object’, ‘got’, ‘office’ and ‘pot’. It is not as open as the English vowel. The lips are more rounded, hence the vowel is closer according to the lip position and it is the counter part to the long vowel /o:/. The difference between long vowel /o:/ and short vowel /o/ in Lambada language is reflected in the position of the first two formants . The first formant is placed at around 450 Hz and the second formant at around 950 Hz, the second formant is not more than 1000 Hz, the third formant is at 2350 Hz. The vowel duration is 120 milliseconds.

6.8. The vowel /o:/

The vowel **/o:/** is a Back, Low mid and Rounded Vowel.

Table 8: Distribution of the vowel /o:/

Lambada words in English script	*Transcription of Lambada words*	*Gloss*
Or	/o:ɾ/	hers
Kon	/ko:n/	Who?
Kor	/ko:ɾ/	gents

The quality of this vowel is not as closed as that of long English vowel / ɔ:/ as in words ‘sword’, ‘court’, ‘fort’ and ‘caught’. It is not as open as short English vowel /ɔ/ in the words ‘lot’, ‘hot’ and ‘cot’. The vowel is nearer to the first part of English diphthong /↔u/ as in words ‘boat’, ‘cold’, ‘gold’, ‘road’ and ‘post’. During the pronunciation of long vowel /o:/ the lips are rounded , the jaw angle is that for a half-closed vowel. The tip of the tongue rests on the gum of the lower front teeth and the back of the tongue raised towards the palato-velar area. The air stream is prevented from going through the nose cavities by the elevation of soft palate, the vocal cords are set in action. The structure of the long vowel /o:/ shows The first formant is placed at 460 Hz, second formant is around 950 Hz and the third formant is situated at 2300 Hz. The vowel duration is 110 milliseconds.

6.9. The vowel /u/

The vowel /**u**/ is a High, Back and Rounded Vowel.

Table 9: Distribution of the vowel /u/

Lambada words in English script	*Transcription of Lambada words*	*Gloss*
Phupa	/pʰupa/	uncle
Undar	/ undaɾ/	rat
Sa:su	/sa:su/	aunt

Compared with English short vowel /u/, as in ‘put’, ‘foot’, ‘took’ and ‘would’, Lambada vowel /u/ is less open, but it is not as closed as English long vowel /u:/ in words such as ‘tool’, ‘food’, ‘moon’ and ‘move’. The lips are rounded and slightly protruded. Vowel /u/ is closed, largely due to the narrow aperture of the lips. The tip of the tongue rests loosely behind the gum of the lower teeth. The front part and the middle of the tongue are gradually raised towards the palato- velar area, creating a narrow passage for the air stream to pass through the mouth. The soft palate is raised the vocal cords are in action and the vowel is fully voiced. The acoustic structure of the vowel is characterized mainly by the first formant which is located around 350 Hz. The second formant is at 1000 Hz and the third formant is situated 2800 Hz. The duration of back vowel is 136 milliseconds.

6.10. The vowel /u:/

The vowel **/u:/** is a Back, Close and Rounded Vowel.

Table 10: Distribution of the vowel /u:/

Lambada words in English script	*Transcription of Lambada words*	*Gloss*
Pool	/pu:ɬ/	Flowers
Moondo	/mu:ndo/	Face
Noon	/nu:nn/	Salt

In the articulation of the vowel /u:/ the lips are rounded and protruded as for a closed back vowel. They are not as rounded as for English long vowel /u:/ and the opening is steady throughout the entire articulation. The jaw angle is neutral as when breathing through the mouth. The tip of the tongue lies loosely behind the gums of the lower front teeth and the back of the tongue is raised towards the soft palate in high position, pulled backwards, it is a close, rounded back vowel. The first formant of long vowel /u:/ is situated around 400 Hz with its lower limit at 350 Hz. The second formant is found at about 900 Hz and the third formant is situated between 2500 Hz and 2800 Hz. The duration of this vowel is 160 milliseconds.

6.11. Diphthongs

Two diphthongs are regular speech sounds in the Lambada language and in all Indian languages as well.

6.11.1. The diphthong /au/

The diphthong **/au/** is a Front Open Unrounded Vowel Just above Half Close.

Table 11: Distribution of the vowel /au/

Lambada words in English script	*Transcription of Lambada words*	*Gloss*
Oudi	/audi/	There/ that side
Gaudi	/gaudi/	Cow
Thaudo	/taudo/	Sunlight

Diphthong /au/ has a more stable quality than diphthong /ai/. Sometimes it is realized as diphthong /ou/ in some Lambada speakers' pronunciation; the glide for this diphthong begins at the back open position and proceeds in the direction of /u/. The lips are neutral in the beginning and weakly rounded at the end. A centralized back rounded vowel just above the half close position shows the first formant at 600 Hz, the second formant is situated at 1190 Hz and the third formant is at 2390 Hz. Its duration is 220 milliseconds.

6.11.2. The diphthong /ai/

The diphthong **/ai/** is a Centralized Back rounded Vowel Just above the half Close position.

Table 12: Distribution of the vowel /ai/

Lambada words in English script	*Transcription of Lambada words*	*Gloss*
Aichik	/aitʃik/	Will you come?
Khai	/kʰai/	What?
Bojai	/bodʒai/	Sister-inlaw

The diphthong /ai/ has a larger field of variety than the diphthong /au/. It may commence with front /a/, in which case the first part of the diphthong has a more frontal position than vowel /a/ or long vowel /a:/ In the production of /ai/ there is a glide from the front open position towards /i/; the starting point is retracted in Lambada language. The lips change from a neutral to a loosely spread position. The first formant is placed at 540 Hz, the second formant is situated at 1790 and the third formant is placed at 2470 Hz. The duration of this diphthong is 270 milliseconds.

7. Average of F1, F2 and F3 of Lambada Vowels (Table 13)

The following table shows the approximant three formants of each vowel as uttered by each speaker and the average formant frequencies of the same vowels.

Table 13: Showing the average Formant Frequencies of the Lambada Vowels

Phoneme	*Speaker1*	*Speaker 2*	*Speaker3*	*Speaker4*	*Speaker 5*	*Average*
/i:/	F1-320 F2-2400 F3-3000	F1-285 F2-2270 F3-2755	F1-290 F2-2390 F3-2945	F1-305 F2-2135 F3-2990	F1-310 F2-2135 F3-2815	302 2266 2901
/i/	F1-310 F2-2100 F3-3150	F1-280 F2-2166 F3-2706	F1-280 F2-2270 F3-2830	F1-270 F2-1880 F3-2940	F1-305 F2-2010 F3-2695	289 2085 2864
/ɛ/	F1-410 F2-2200 F3-2500	F1-399 F2-1820 F3-2590	F1-410 F2-1855 F3-2815	F1-490 F2-1815 F3-2530	F1-465 F2-1650 F3-2560	434 1868 2599
/ɛ:/	F1-461 F2-2380 F3-2650	F1-365 F2-2020 F3-2550	F1-410 F2-2080 F3-2880	F1-450 F2-2055 F3-2685	F1-410 F2-1830 F3-2710	419 2073 2695
/a/	F1-800 F2-1600 F3-2650	F1-500 F2-1550 F3-2655	F1-560 F2-1610 F3-2740	F1-562 F2-1600 F3-2730	F1-560 F2-1610 F3-2720	596 1594 2699
/a:/	F1-750 F2-1350 F3-3000	F1-670 F2-1350 F3-2310	F1-750 F2-1360 F3-2490	F1-700 F2-1275 F3-2515	F1-670 F2-1190 F3-2495	708 1305 2562
/o/	F1-450 F2-950 F3-2300	F1-435 F2-1005 F3-2675	F1-475 F2-1060 F3-2810	F1-456 F2-960 F3-2615	F1-455 F2-953 F3-2510	454 985 2582
/o:/	F1-460 F2-950 F3-2300	F1-425 F2-1010 F3-2724	F1-430 F2-1070 F3-2740	F1-440 F2-890 F3-2415	F1-556 F2-1095 F3-2375	462 1003 2510
/u/	F1-350 F2-1000 F3-2800	F1-340 F2-1070 F3-2670	F1-325 F2-1030 F3-2730	F1-270 F2-1040 F3-2800	F1-350 F2-935 F3-2645	327 1015 2729
/u:/	F1-400 F2-900 F3-2800	F1-345 F2-970 F3-2680	F1-325 F2-975 F3-2720	F1-330 F2-1160 F3-2430	F1-326 F2-1162 F3-2435	345 1033 2613
/au/	F1-600 F2-1190 F3-2390	F1-500 F2-1070 F3-2570	F1-610 F2-1200 F3-2460	F1-555 F2-1060 F3-2320	F1-540 F2-1095 F3-2450	561 1123 2438
/ai/	F1-540 F2-1790 F3-2470	F1-400 F2-1960 F3-2520	F1-410 F2-1965 F3-2500	F1-480 F2-1650 F3-2320	F1-455 F2-1735 F3-2560	457 1820 2474

8. Conclusion

The primary objective of this study is to find out the inventory of the vowel sounds of Lambada language because there are no more linguistic works on tribal languages till today. It is time to look at those languages before they get endangered by the influence and intrusion of the regional and global languages. I felt a need to work on these tribal languages because of the dearth of research work on these languages. It is my deep desire in contribute to the documentation and preservation of language and making the next generations know the greatness of our linguistic heritage. The list of vowels that have been identified in the research may not be exhaustive but certainly a leap towards a substantial linguistic work in this area. Apart from this paper, there is a wider scope even to work on the consonants in the Lambada language.

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