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Computation of NasalanceVariation in Manipuri as measured through Nasal View and NasometerII

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Abstract: *With dearth of research regarding normative nasalance computation in Indian tonal languages like Manipuri, it is essential to study the effect of nasalance variation in Manipuri using Nasal View and NasometerII. The present study aimed to compare and establish variations in mean nasalance in Manipuri language as measured using Nasal View and NasometerII.A total of 60 subjects within the age range of 18 to 40 years wereequally divided into two groups Group I and II each consisting of 30 males and 30 females. All the subjects had Manipuri language as thenative language. A total of fiveoral and five nasal sentenceswere developed and were used as stimuli. The NasometerII and Nasal Viewinstruments were used for measurement of mean nasalance scores and standard deviation. The mean nasalance values as obtained through Nasal view showed higher scores than NasometerII across both oral and nasal sentences.The findings of the study thus indicate significant variation to be present across nasalance values in Manipuri language as measured through Nasal View and NasometerII. The results of this study may thus help in predicting prognosis and in monitoring the success of speech therapeutic rehabilitation.*

Keywords: *Nasalance, Manipuri, Nasometer II, Nasal View, Normal speakers.*

I. Introduction

Nasalance has been defined as the balance between the acoustic energy at the nares, $A_{n,}$ and the acoustic energy at the mouth, $A_{o,}$ during voiced speechand has long been used as an acoustical measure for predicting velopharyngeal closure (Fletcher and Frost, 1974).Various methods for nasalance measurement have been documented in literature (Baken, 1987). Amongst the documented procedures, the oral/nasal sound-pressure-ratio methods for nasalance computation has gained wide acceptance and is being routinely used in research and clinical practice globally (Baken and Orlikoff, 2000). In the recent years, commercially available instruments such as Nasometer II and Nasal View have become unanimous among clinicians and researchers for computation of mean nasalance (mean F1 nasalance). The Nasometer II and Nasal View instruments assesses the nasality of speech by measuring the acoustic output from both the nasal and oral cavity by using two microphones, separated by an acoustic shield that rests on the upper lip, which is mounted on a head set which gives appropriate position for the microphones. In the recent years, other instrument like Nasal view have been developed and is marketed by their manufacturer as less expensive and more clinical alternatives to the Nasometer. Like the Nasometer, the Nasal View computes nasalance as an instensity ratio but the two systems have different acoustical filtering characteristics. Before computing nasalance, the Nasometer II filters the incoming acoustic signals from the oral and nasal microphones with a 300-Hz bandwidth filter having a centre frequency at 500 Hz. The Nasal View, however, does not filter the incoming signal.

Velopharyngeal activity in terms of nasalance measure is language specific because it is evident from different literature research that nasalance scores vary in different languages. Therefore, normative nasalance scores should be established for each language. Zoo passage (Fletcher, 1972), Rainbow passage (Fairbanks, 1960) and Nasal Sentences (Fletcher, 1978) are extensively used standardized passages for evaluation of nasalance in native speakers of English. In Indian context, very few studies have been done to measure nasalance scores using oral and nasal sentences as stimuli in Marathi, Tamil and Kannada languages by Nandurkar (2002), Sunitha, RoopaNagarajan and Prakash (1994) and Jayakumar and Pushpavathi (2005) respectively. Arya (2009) and Ravindran (2009), considered oral and nasal sentences and paragraphs in Hindi and Malayalam languages. Kumar, Chakrabarty, Shailat and Singh (2012) developed phonemically balance passage, Oral passage and Nasal passage for the measurement of nasalance in Bangla.

Manipuri language (*Meiteilon),* is a tonal language which is also used as a lingua franca among the 29 different ethnic groups of Manipur is a minimally chosen language for language researches in India. Any acoustic studies to measure nasalance scores and development of passages in Manipuri language are not available till date. Normative nasalance scores are critical values to identify patients with Velopharyngeal impairments, hearing loss, dysarthria, resonance disorder etc. This makes strong need for the establishment of regional norms and regional stimuli for normal speakers especially the north-eastern language like Manipuri for the assessment and treatment of above mention patients. This will help the speech clinician to formulate a

recommendation and subsequently the direction to form the treatment program to be taken for better intelligibility of speech.

The aim of the study was to compare mean nasalance measured by Nasal View and NasometerII in Manipuri language. The objectives of the study were to develop oral and nasal sentences five in number in each category and those sentences were linguistically validated, to obtain mean nasalance scores by using Nasometer, to obtain the nasalance scores by using Nasal View, to compare mean nasalance scores across Nasal View and Nasometer, to measure internal consistency with reference to within group variation in each measured trials across instruments, to examine the effects of gender differences on mean nasalance scores in Manipuri language. It was hypothesized that there will be a significant difference of the mean nasalance scores obtained from Nasometer and Nasal view in native speakers of Manipuri language and also there will be a significant difference between the mean nasalance measures of female and male native speakers of Manipuri language.

II. Methodology

Participants: A total of 60 native Manipuri speakers (30 males and 30 females) within the age range of 18 to 40 years (mean age = 29 years and SD= 6.78 years) were selected for the study. The male and female participants were divided into groups 1 and group 2 respectively. Group 1 constituted 30 males with mean age of 23.2 years and SD of 3.44 years and group 2 constituted 30 females with mean age of 22 years and SD of 2.71 years. Written consent was obtained from all the participants prior to participation in the study.

2.1 Inclusion criteria:

1. All the participants were native Manipuri speakers and were within the age range of 18 to 40 years.
2. All the participants were able to read written script in Manipuri.

2.2 Exclusion Criteria:

The participants fulfilling the following criteria were excluded from the study:

1. Participants with cognitive or intellectual deficits.
2. Participants who were not physically fit to endure the test.
3. Participants with any ocular abnormalities other than corrected vision.
4. Participants with any craniofacial anomalies or structural deformity in orophayngeal or nasopharyngeal mechanism.
5. Participants with history of speech, language and hearing disorder, perceived resonance disorder, prolonged active cold or other upper respiratory tract infections

2.3 Instrumentation:

The Nasometer II Model 6400 (software version 2.6) and Nasal View Model T- 02 connected to a64 bit personal computer was used for measurement of mean nasalance. Both instruments comprises of a headset with a sound-separator plate which rests on the subject's upper lip and two microphones on either side which detects oral and nasal components of the speech. The signal from each of the microphones is filtered individually and digitized by customized electronic modules. The resulting value gives a ratio of the total nasal energy and the nasal plus oral acoustic energy which upon multiplied with hundred gives the percentage nasalancescore.The developed oral and nasal sentences were used in computation of nasalance.

2.4 Test environment:

Recording of the nasalance samples were done in a partially acoustic treated room with permissible ambient noise level within 20 dBA.

2.5 Procedure:

The study was carried out in three stages.

2.6 Stage 1: Development of test stimuli

A total of 100 content and function words having nasal and oral phonemes were selected from published books. These included Manipuri to English Dictionary (Imoba, 2004), Pukeilol (Sagolsem, 2014), Grammars (Singh, 2000), and Manipuri newspapers. The words which were most frequently occurring in the text books (high frequency words) were included. Words containing nasal sounds in initial, medial, and final position of words and in combination with other phonemes (possible and allowed by Manipuri language rule and clusters) were taken.Similarly content and function words containing no nasal phonemes were also selected. The selected words were used for preparing two sets of meaningful Manipuri sentences one containing nasal phonemes and another devoid of nasal phonemes. Morphophonemic economy was taken into consideration during arrangement of words in the sentences. Linguistic validity was obtained by three linguists through inter-rater agreement by using Cronbach alpha (0.84). Each final sentence set consisted of 5 sentences(Refer to Appendix 1 and 2). One set consisted of oral sentences andpredominantlycontained oral consonants and the other set consisted of nasal sentences, which predominantly hadnasal consonants.

2.7 Stage 2: Administration of test stimuli on the sample population

2.8 Calibration:

The Nasometer II and Nasal View instruments were calibrated based on manufacturer instructions prior to administration of the developed test sentences in each session.

2.9 Recording of sample

The subjects were seated in a comfortable chair in front of the computer monitor. The headpiece was placed on the subject's head such that the oral and nasal microphones were at equal distances from the mouth & nose. The participants were instructed to read the printed form of the developed Manipuri oral and nasal sentences. The participants were asked to read the sentences at normal loudness at a normal rate of speech after the recording icon was clicked. The participants were also instructed not to add any fillers like /umm/ or /ah/ in between. However, the participants were allowed to pause in between reading but to resume reading from where they stopped. A total of three mean nasalance values of the oral and nasal sentences wereobtainedfor both the groups using Nasometer II and Nasal View instruments.The mean of the three obtained mean nasalance values of each participant across the two instruments was calculated and tabulated.

2.10 Stage 3: Tabulation and statistical analysis

The mean nasalancevaluesof all the participants for bothsentence sets obtained across the two instruments were tabulated using Microsoft office excelpackage for Windows 2007 software. Statistical analysis of the obtained nasalance values was done using SAS (version 9.0). Descriptive statistic was used for computation of mean nasalance scores and standard deviation. Pearson correlation coefficient was used for finding correlation between oral and nasal sentences as measured on Nasometer and Nasal View. Paired t-test was used for comparison of mean nasalance scores across the two instruments for oral and nasal sentences. t- test was used to compare significant difference on mean nasalance scores between male and female. Co efficient of variation was used for checking internal consistency with reference to within group variation in each measured trials across instruments.

III. Results And Discussion

3.1 Comparison of mean nasalance scores across Nasal View and Nasometer

The mean nasalance score and standard deviation for oral and nasal sentences were (19.31 and 6.27) and (53.12 and 6.79) respectively for all 60 subjects of native Manipuri speakers as measured on Nasometer as shown in table 4.5. The mean nasalance score and standard deviation for oral and nasal sentences were (34.47 and 7.96) and (56.25and 5.00) respectively for all 60 subjects of native Manipuri speakers as measured on Nasal View as shown in table 4.7. The difference in mean nasalance score and standard deviation for oral sentences and nasal sentences between Nasometer and Nasal View were (-14.38, 6.56) and (-3.13, 5.61) respectively as reported in table 4.9 and table 4.11. Paired t-test was done to compare the mean nasalance score for Nasometer and Nasal View oral and nasal sentences as reported in table4.10 and table 4.12 respectively. The result shows a significant difference in mean nasalance scores across the instrument for oral sentences at ($t= -16.95$; $p<.0001$) and for nasal sentences at ($t= -4.32$; $p<.0001$). The Nasal view shows higher mean nasalance scores than Nasometer in both oral and nasal sentence.

Table 1. Mean nasalance score and standard deviation as measured on Nasometer

Variable	Mean	S.D
Oral Sentence	19.31	6.27
Nasal Sentence	53.12	6.79

Table 2. Mean nasalance score and standard deviation as measured on Nasal View

Variable	Mean	SD
Oral sentence	34.47	7.96
Nasal sentence	56.25	5.00

Table 3. Difference Mean nasalance score and SD between Nasometer and Nasal View Oral sentences

Variable	Mean	SD
Nasometer oral sentence - Nasal view oral sentence	-14.38	6.56

Table 4. Difference Mean nasalance score and SD between Nasometer and Nasal View Nasal sentences

Variable	Mean	SD
Nasometer nasal sentences - Nasal view nasal sentences	-3.13	5.61

Table 5. Degree of freedom and t-value of comparison of means for Nasometer and Nasal View Oral sentences

Difference	DF	t-value	P value
Nasometer Oral sentence- Nasal View Oral sentence	59	-16.95	<.0001

Table 6. Degree of freedom and t-value of comparison of means for Nasometer and NasalView Nasal sentences

Difference	DF	t-value	Pr>|t|
Nasometer Nasal sentence- Nasal View Nasal sentence	59	-4.32	<.0001

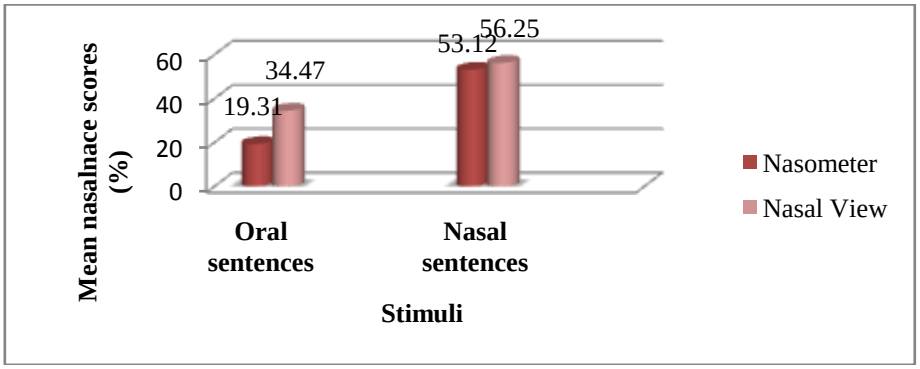

Figure 1: Mean nasalance scores of oral and nasal sentences across Nasometer and Nasal View.

3.2. Correlation between oral and nasal sentences as measured on Nasometer and Nasal View

The establishment of regional norms and regional stimuli for normal speakers especially the north-eastern language like Manipuri for the assessment and treatment program is required as nasalance scores varies in different languages i.e. Flemish (Van Lierde et al., 2001), Hungarian (Hirschberg et al. 2006), Japanese (Tachimura, Moris, Hirata and Wada, 2000), Cantonese (Whitehill, 2001). Therefore, Oral and nasal sentence five in numbers in each category was developed and linguistic validation of those sentences were obtained by three linguists through inter-rater agreement using chronbach alpha (0.84). Pearson correlation was computed to measure significant correlation between oral and nasal sentences as measured on Nasometer and Nasal View as depicted in table 4.6 and table 4.8. The result shows that oral and nasal sentences were highly correlated at ($r=0.55$; $p<.0001$) for Nasometer and for Nasal View at ($r= 0.75$; $p<.0001$).

Table 7. Pearson Correlation between Oral and Nasal sentences as measured on Nasometer

Variable	Oral sentence	Nasal sentence
Oral sentences	1.00000	0.55
Nasal sentences	0.55	1.00000

Table 8. Pearson Correlation between Oral and Nasal sentences as measured on Nasal View

Variable	Oral sentence	Nasal sentence
Oral sentences	1.00000	0.75
Nasal sentences	0.75	1.00000

3.2. Mean nasalance of native speakers of Manipuri language

The mean nasalance score and standard deviation of the native speakers of Manipuri language for oral sentences using Nasometer was (19.02, 8.93) for group I (male) and for group II (female) was (21.16, 8.54) as shown in TABLE 9. For nasal sentences mean and standard deviation was (53.11, 7.54) for group I (male) and for group II (female) was (53.14, 6.08) using Nasometer as shown in TABLE 10.The mean and standard deviation of nasalance scores for oral sentences were computed using Nasal View i.e. mean 35.04 and standard deviation 7.71 for group I (male) and for group II (female) mean 33.9 and standard deviation 8.30 as reported in TABLE 11. Using the Nasal View mean and standard deviation of nasalance score for nasal sentences was also computed which showed mean 56.65 and standard deviation 4.89 for group I (male) and for group II (female) was 55.85 and standard deviation 5.17 as shown in TABLE 12.

Table 9. Mean and SDnasalance score of group-I and group-II as measured on oral sentences using Nasometer

Oral sentences	Group I (Male)	Group II (Female)
Mean	19.02	21.16
SD	8.93	8.54

Table 10. Mean and SD nasalance scores of group-I &II as measured on Nasal sentences using Nasometer

Nasal sentences	Group I (Male)	Group II (Female)
Mean	53.11	53.14
SD	7.54	6.08

Table 11. Mean and SD of nasalance scores of group-I and II as measured on Oral sentences using Nasal View

Oral sentences	Group I (Male)	Group II (Female)
Mean	35.04	33.91
SD	7.71	8.30

Table 12. Mean and SD of nasalance scores of group-I and II as measured on Nasal sentences using Nasal View

Nasal sentences	Group I (Male)	Group II (Female)
Mean	56.65	55.85
SD	4.89	5.17

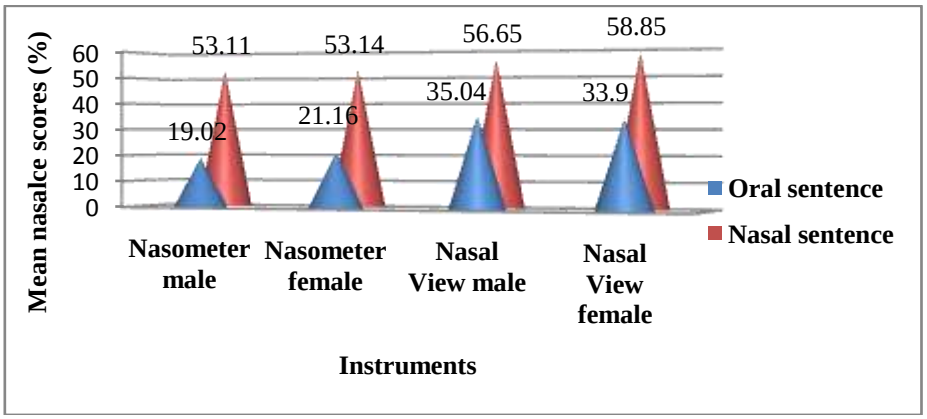

Figure 2: Graphical representation showing mean nasalance scores of nasal sentences

3.3. Nasalance Scores: Female vs. Male using Nasometer and Nasal view

The mean nasalance scores obtained were compared for male and female across the two instruments. From the TABLE 13, the mean nasalance and standard deviation of female for oral sentences using Nasometer is 21.16, 8.54 and for male is 19.02, 8.93. There is insignificant difference on mean nasalance scores of female and male oral sentences using Nasometer at (p value = 0.34, t = 0.95, DF = 58) as reported in TABLE 14. For nasal sentences the mean nasalance and standard deviation of female is 53.14, 6.08 and for male is 53.11, 7.54 as shown in TABLE 15. There is insignificant difference in mean nasalance scores for nasal sentences using Nasometer at (p value = 0.98, t = 0.02, DF= 58) as shown in TABLE 16. The mean and standard deviation for oral sentences using Nasal View were 33.91, 8.30 for females and 35.04, 7.71 for males as shown in TABLE 17. No gender differences on mean nasalance score for oral sentences using Nasal View have been found at (p value = 0.58, t= -0.55, DF=58) as depicted in TABLE 18. The mean and standard deviation for nasal sentences using Nasal View were 55.8, 5.17 for females and 56.6, 4.89 for males as shown in TABLE 19. There was insignificant difference on mean nasalance scores for nasal sentences between males and females at (p value = 0.54, t= -0.62, DF=58) as depicted in TABLE 20.

Table 13: Mean and standard deviation of gender differences for oral sentences using Nasometer

Variable	Gender	Observation	Mean	StdDev
Nasometer Oral sentences	Female	30	21.16	8.54
	Male	30	19.02	8.93
	Diff (1-2)		2.14	8.74

Table 14: Degree of freedom and t-value of comparison of means gender differences for oral sentences using Nasometer

Variable	Method	Variances	DF	t-value	Pr>|t|
Nasometer Oral sentences	Pooled	Equal	58	0.95	0.34
	Satterthwaite	Unequal	57.9	0.95	0.34

Table 15: Mean and standard deviation of gender differences for nasal sentences using Nasometer

Variable	Gender	Observation	Mean	StdDev
Nasometer Nasal sentences	Female	30	53.14	6.08
	Male	30	53.11	7.54
	Diff (1-2)		0.0267	6.85

Table 16. Degree of freedom and t-value of comparison of means of gender differences for nasal sentences using Nasometer

Variable	Method	Variances	DF	t-value	Pr>|t|
Nasometer Nasal sentences	Pooled	Equal	58	0.02	0.98
	Satterthwaite	Unequal	55.5	0.02	0.98

Table 17. Mean and standard deviation of gender differences for oral sentences using Nasal View

Variable	Gender	Observation	Mean	StdDev
Nasal View Oral sentences	Female	30	33.91	8.30
	Male	30	35.04	7.71
	Diff (1-2)		-1.13	8.01

Table 18. Degree of freedom and t-value of comparison of means gender differences for oral sentences using Nasal View

Variable	Method	Variances	DF	t-value	Pr>|t|
Nasal View Oral sentences	Pooled	Equal	58	-0.55	0.58
	Satterthwaite	Unequal	57.7	-0.55	0.58

Table 19. Mean and standard deviation of gender differences for Nasal sentences using Nasal View

Variable	Gender	Observation	Mean	StdDev
Nasal View Nasal sentences	Female	30	55.8	5.17
	Male	30	56.6	4.89
	Diff (1-2)		-0.8	5.0351

Table 20. Degree of freedom and t-value of comparison of means of gender differences for nasal sentences using Nasal View

Variable	Method	Variances	DF	t-value	Pr>|t|
Nasal View Nasal sentences	Pooled	Equal	58	-0.62	0.54
	Satterthwaite	Unequal	57.8	-0.62	0.54

3.4. Comparison of mean nasalance scores between male vs. male and female vs. female for oral and nasal sentences across Nasometer and Nasal View

Difference means nasalance score and standard deviation between male Nasometer oral sentences and male Nasal View oral sentence is -16.1 and 6.11. The difference means nasalance score and standard deviation for male Nasometer nasal sentences and male Nasal View nasal sentences is -3.53 and 5.32. t-test shows significant differences on mean nasalance scores of male Nasometer oral sentences and male Nasal View oral sentences at ($p<.0001$) and also found significant differences on male Nasometer nasal sentences and male Nasal View nasal sentences at ($p<.0011$) respectively as reported in TABLE 21 and TABLE 22. There were also significant differences on female oral sentences across the Nasometer and Nasal View (mean difference = -12.74, $p<.0001$) and for nasal sentences across Nasometer and Nasal View (mean difference = -2.70, $p<.01$) as shown in TABLE 23 and TABLE 24. The significant differences on mean nasalance scores measured by Nasometer and Nasal View for oral and nasal sentences within same group may be inferred from different acoustic filtering used in both instruments.

Table 21. Difference Mean nasalance score, standard deviation, degree of freedom and t value of comparison of mean nasalance between male Nasometer oral sentences and male Nasal View oral sentences

Difference	N	Mean	StdDev	DF	t-value	Pr>|t|
Male Nasometer oral sentences-Male Nasal View oral sentences	30	-16.1	6.11	29	-14.41	<.0001

Table 22. Difference Mean nasalance score, standard deviation, degree of freedom and t value of comparison of mean nasalance between male Nasometer nasal sentences and male Nasal View nasal sentences

Difference	N	Mean	StdDev	DF	t-value	Pr>|t|
Male Nasometer nasal sentences-Male Nasal View nasal sentences	30	-3.53	5.32	29	-3.63	<.0011

Table 23. Difference Mean nasalance score, standard deviation, degree of freedom and t value of comparison of mean nasalance between female Nasometer oral sentences and female Nasal View oral sentences

Difference	N	Mean	StdDev	DF	t-value	Pr>|t|
Female Nasometer oral sentences-Female Nasal View oral sentences	30	-12.74	6.67	29	-10.45	<.0001

Table 24. Difference Mean nasalance score, standard deviation, degree of freedom and t value of comparison of mean nasalance between female Nasometer nasal sentences and female Nasal View nasal sentences

Difference	N	Mean	StdDev	DF	t-value	Pr>|t|
Female Nasometer nasal sentences-Female Nasal View nasal sentences	30	-2.703	5.95	29	-2.49	0.0189

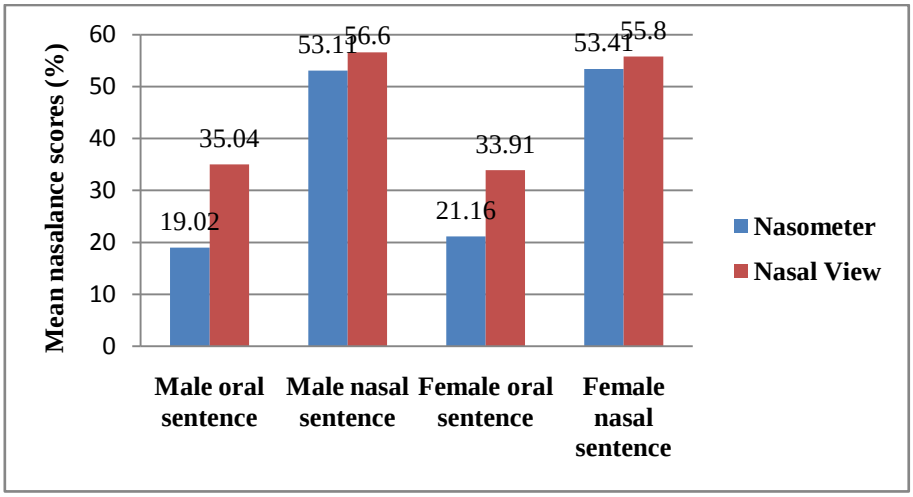

Figure 3. Comparative mean nasalance scores measured by Nasometer and Nasal View within same gender. X-axis represents gender and Y- axis represents mean nasalance scores (%).

3.5. Internal consistency with reference to within group variation in each measured trials across instruments

In the present study all the subjects were given three trials for each category i.e. for oral sentences and nasal sentences allowing 10 minutes interval. Coefficient of variation across instrument was computed for internal consistency in each trial within groups as depicted in TABLE 25. Results reveal that first, second and third trial of male oral sentence has CV (50.77, 43.83, and 48.84) for Nasometer and (21.59, 22.78, and 27.12) for Nasal View respectively. Lesser the CV higher the consistency, therefore second trial is consistent than other two for Nasometer male oral sentence and first trial is consistent than other two for Nasal View male oral sentence. First, second, and third trial of male nasal sentence has CV (15.19, 13.87, and 14.07) for Nasometer and (9.35, 9.24, and 8.24) for Nasal View respectively. Second trial is consistent than other two for Nasometer male nasal sentence and third trial is consistent than other two for Nasal View male nasal sentence. First, second, and third trial of female oral sentence has CV (41.03, 40.31, and 41.60) for Nasometer and (24.74, 24.37, and 25.63) for Nasal View respectively. Second trial is consistent than other two for both Nasometer and Nasal View female oral sentence. First, second, and third trial of female nasal sentence has CV (10.76, 12.13, and 12.50) for Nasometer and (10.18, 9.34, and 9.16) for Nasal view respectively. First trial is consistent than other two for Nasometer female nasal sentence and third trial is consistent than other two for nasal View female nasal sentence. Much variability has been observed in terms of internal consistency in each measured trials within group between instruments. Most variability between instruments in each measured trials within group could be explained as within-subject performance variability and variability associated with headgear changes (Lewis, Watterson and Brancamp, 2005).

Table 25. Coefficient of variation across Nasometer and Nasal View for internal consistency in each measured trials within group

Variables	Trials	Coefficient of variation (CV) for Nasometer	Coefficient of variation (CV) for Nasal View
Male oral sentence	1	50.77	21.59
	2	43.83	22.78
	3	48.84	27.12
Male nasal sentence	1	15.19	9.35
	2	13.87	9.24
	3	14.07	8.24
Female oral sentence	1	41.03	24.74
	2	40.31	24.37
	3	41.60	25.63
Female nasal sentence	1	10.76	10.18
	2	12.13	9.34
	3	12.50	9.16

IV. Summary & Conclusion

The Velopharyngeal (VP) mechanism consisting of the velum (soft palate) and the pharynx has been extensively explored and marked variability in VP function between individuals has been observed (Skolnick et al., 1975). Some nasal phonemes are present in all languages, commonly /m/, /n/ &/ŋ/. During the production of oral sounds, velopharyngeal closure should be complete. For nasal sounds, sound energy should be relatively unimpeded through the pharynx and nasal cavity (Moller and Starr, 1993). A nasal speech quality caused by velopharyngeal disorder sounds noticeably abnormal to the listener making speech weak, indistinct and difficult to understand. The amount of nasality can be numerically measured by the Nasometer with high objectivity and reproducibility (Seaver et al., 1991). In the recent years, other instruments like Nasal View have been developed by Awan (1996; 1998) which also computes nasalance as an intensity ratio but the two systems have different acoustical filtering characteristics. Nasalance scores allow the Speech language pathologist to corroborate a perceptual assessment and to provide additional quantitative measures. From the review of literature it is evident that nasalance scores varies in different languages (Van Lierde et al., 2001; Hirschberg et al., 2006; Tachimura, Moris, Hirata and Wada, 2000; Whitehill,2001).Different studies have also shown that nasalance of normal speech is sensitive to the phonetic composition of the speech stimuli, native language, regional dialect, age and gender. Therefore, Establishment of regional norms and regional stimuli is important.

The present study will be helpful and provide important reference information for several clinicians who assess resonance disorders in Manipuri language. Speech pathologists can measure the effects of a specific therapy approach, and the plastic surgeon can evaluate the effects of different nasal and pharyngeal surgical techniques.

References

[1]. Anderson, R. T. (1996). Nasometric values for normal Spanish-speaking females: a preliminary report. The Cleft palate-craniofacial journal, 33(4), 333-336.

[2]. Awan, S. N., & Powell, T. W. (1996). Development of a low-cost nasalance acquisition system. Pathologies of Speech and Language: Contributions of Clinical Phonetics and Linguistics. New Orleans, LA: International Clinical Linguistics and Phonetics Association, 1-217.

[3]. Awan, S. N. (1998). Analysis of nasalance: NasalView. Clinical Phonetics andLinguistics.London:Whurr-Publishers, 518-525.

[4]. Arya, p., (2009). Normative nasalance value in Hindi language. Unpublished dissertation submitted to the University of Mysore, Mysore (personal communication).

[5]. Bressmann, T., Sader, R., Awan, S., Busch, R., Zeilhofer, H. F., &Horch, H. H. (1999).Quantitative Hypernasalitätsdiagnostikbei LKG-PatientendurchcomputerisierteNasalanzmessung. Mund-,Kiefer-und Gesichtschirurgie, 3(1), 154-157.

[6]. Ch. Yashawant Singh, (2000). Manipuri Grammar. Rajesh Publications, New Delhi.

[7]. Dr. SoibamImoba(2004). Manipuri to English Dictionary. .

[8]. Fairbanks, G. (1960). Voice and articulation drill book, New York: Harper & Row.

[9]. Fletcher, S. G., & Bishop, M. E. (1970). Measurement of nasality with TONAR. The Cleft palate journal, 7, 610...

[10]. Fletcher, S. G. (1978). Diagnosing speech disorders from cleft palate. Saunders.

[11]. Hirschberg, J., Bók, S., Juhász, M., Trenovszki, Z., Votisky, P., & Hirschberg, A. (2006). Adaptation of nasometry to Hungarian language and experiences with its clinical application. International journal of pediatric otorhinolaryngology,70(5), 785-798..

[12]. IbomchaSagolsem (2014). Pukeilol (English-Meitei Dictionary with English-Meitei-Bangla Scripts).

[13]. Jayakumar, T., &Pushpavathi, M. (2005). Normative score for nasometer in Kannada. Student research at AIISH (Articles based on dissertation done at AIISH), 7, 44-53.

[14]. Kavanaugh, J., L., Fee, E., J., Kalinowaski, J., Doyle, P.,C., Leeper, H.,A. (1994) Nasometric values for three dialectal groups within the Atlantic provinces of Canada. Journal speech language pathology audiology,18, 7-13.

[15]. Kumar, S., Chakrabarty, M., Shailat, R. K., & Singh, P. (2012). Development of a Phonemically Balanced Passage, Oral Passage, and Nasal Passage for the Measurement of Nasalance in Bangla. Asia Pacific Journal of Speech, Language and Hearing, 15(2), 85-91.

[16]. Moller, K. T., & Starr, C. D. (Eds.). (1993). Cleft palate: Interdisciplinary issues and treatment. Pro Ed.

[17]. Nandurkar, A. (2002). Nasalance measures in Marathi consonant-vowel-consonant syllables with pressure consonants produced by children with and without cleft lip and palate. The Cleft palate-craniofacial journal, 39(1), 59-65.

[18]. Owens, Jr. R.E. (1990). Development of communication, language, and speech. In: Shames, G.H., &Wigg, E. H. (edf). Human communication disorder. Columbus: Merrill publishing company.
[19]. Ravindran, T. D. (2009). Normative nasalance value in Malayalam language. An unpublished dissertation, Universityof Mysore.
[20]. Skolnick, M. L., Shprintzen, R. J., McCall, G. N., &Rakoff, S. (1975). Patterns of velopharyngeal closure in subjects with repaired cleft palate and normal speech: A multi-view videofluoroscopic analysis. Cleft Palate J, 12(369-376), 27..
[21]. Seaver, E., J., Dalston, R., M., Leeper, H., A., Adams, L., E., (1991) A study of nasometric values for normal nasal resonance. Journal of speech, Hearing and resonance,34,715-721.
[22]. Sunitha, Roopa, N., &Prakash, B. (1994). Proceedings of 4th Annual congress of Indian Society of Cleft lip, Palate & Craniofacial Anomalies (Abstract). Hyderabad, India.
[23]. Stevens, K.N. (1998). Acoustic phonetics MIT press, Cambridge, Mass.
[24]. Sweeney, T., Sell, D., &O'Regan, M. (2004). Nasalance scores for normal-speaking Irish children. The Cleft palate-craniofacial journal, 41(2), 168-174.
[25]. Tachimura, T., Mori, C., Hirata, S. I., & Wada, T. (2000). Nasalance score variation in normal adult Japanese speakers of Mid-West Japanese dialect. The Cleft palate craniofacial journal, 37(5), 463-467.
[26]. Van Lierde, KM., Wuyts, F. L., Bodt, M. D., &Cauwenberge, P. V. (2001). Nasometricvalues for normal nasal resonance in the speech of young Flemish adults. The Cleft palate-craniofacial journal, 38(2), 112-118.
[27]. Whitehill, T. L. (2001). Nasalance measures in Cantonese-speaking women.The Cleft palate craniofacial journal, 38(2), 119-125.
[28]. Watterson, T., Lewis, K., &Brancamp, T. (2005). Comparison of nasalance scores obtained with the Nasometer 6200 and the Nasometer II 6400. The Cleft palate-craniofacial journal, 42(5), 574-579.