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ASSESMENT OF REFERENCE VALUES FOR NASAL BONE LENGTH IN FETUSES AT 16-24 WEEKS OF GESTATIONAL AGE IN NORTH-EASTERN INDIAN POPULATION VISITING TERTIARY CARE CENTRE"

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ABSTRACT

Background: Detection of chromosomal abnormalities were initially based on pregnant women`s age and biochemical markers, however with the advent of sonography, images of fetal nose during 2nd trimester helps in accurately predicting chance of chromosomal birth defect. The objective of this study is to determine reference values for nasal length (NBL) at 16-24 weeks of gestation within North-EasternIndian population visiting tertiary care Centre. **Methods:** This descriptive cross-sectional study 400 Pregnant Indian women of North-Eastern region with singleton pregnancies in gestationalage of 16-24 weeks in the age group of 18-32 years of age. In this study, Doppler sonography was performed using 1–7 MHz curvilinear array transducers (SAMSUNG RS80A Ultrasound System). **Results:** Among 400 patients, the fetal nasal bone length was obtained and various relationships between different population based studies were obtained. **Conclusion:** Our study of 400 patients resulted in linear relationship of fetal nasal bone length to weeks of gestation with subtle differences between various Indian population based studies.However there is a wide variation between Chinese and Japanese populations, suggesting the role of ethnicity.

KEYWORDS: Sonography, fetal nasal bone length, downssyndrome, ethnicity.

INTRODUCTION

Screening for chromosomal abnormalities was formerly based onpregnant woman's age and maternal biochemical markers.

However, sonographic images of fetal nose during 2nd trimester helps in accurately predicting chance of chromosomal birth defect with specificity around 77.7%.

The fetal nasal bone can be visualized by sonography at 16 to 24weeks of gestation in 99.5% of normal fetuses.

Otano et al.[1] reported absence of fetal nasal bone in 60% of fetuses with Down syndrome, while Orlandi et al.[2] observed absence of fetal nasal in 67% of fetuses with downs syndrome and 1% in chromosomally normal fetuses.

Prefumo et al[3] also showed a trend of a higher incidence of an absent nasal bone in fetuses of healthy Asian mothers.

Moreover, hypoplasia and absence of the nasal were also reported in36% and 2.5% respectively in aborted fetuses.

It is essential to notice that nasal length measurement is impacted by race and ethnicity. Therefore, racial adjustment is required within the measurement of fetal nasal in screening for downs syndrome during pregnancy.

Reference values for nasal bone length have been reported indifferentcountries and ethnic populations.

However, no study ascertaining reference ranges for the nasal bone length inNorth-Eastern Indian population have been carried out.

Thus, this prospective, cross-sectional study was conducted to determine reference values for nasal length (NBL) at 16-24 weeks of gestation within North-Eastern Indian population visiting tertiary care Centre.

MATERIALS AND METHODS

This descriptive cross-sectional study was conducted in the department of Radio-diagnosis of a tertiary care center in North-East India over a 12-month period from November 2019 to October 2020.

The study was approved by the "Institutional Ethics

Committee of Gauhati Medical College and Hospital, Guwahati" (approval no.: MC/190/2007/Pt-11/MAR-2009/P.G/113; approval date: 10/04/2019) and the protocol complied with the Declaration of Helsinki.

Four hundred Pregnant Indian women of North-Eastern region with singleton pregnancies in gestational age of 16-24 weeks in the age group of 18-32 years of age, with gestational age confirmed by a dating scan and no known fetal abnormality or pregnancy complication were selected for the purpose.

Both inpatients and outpatients attending the hospital were taken upfor the study.

However, patients with multiple gestations and any pregnancy-related complications were excluded from the study.

Data Collection

A detailed histories of all the patients referred to the Department of Radiodiagnosis, Gauhati medical college, Guwahati fulfilling the selection criteria are taken and risk factors are documented.

All the patients were subjected to antenatal examination after taking informed consent for the same.

Equipment

Antenatal ultrasonography was performed using the curvilinear array of 3.5 MHz (Obstetric Mode)and 3D volume transducer in 2D and 3D modes (SAMSUNG RS80A Ultrasound System).

Image modification was done with Zoom for real-time or frozen.

The stored image in equipment is transferred to the optical storagemedium and used.

Study Procedures

After taking detailed history scans are performed with the patient supine. A generous amount of gel is taken and probe is then placed over the abdomen.

In measuring the nasal bone length, a sagittal section of the fetal profile was obtained with the ultrasound transducer at an angle between 45 to 135 to the facial plane.

Three images were obtained for each patient, and one measurement per imagewas taken for each patient.

The image was magnified so that the fetal head and upper thorax were presenton the 75% of the screen.

The nasal bone and naso-frontal synostosis, which appear as an anechoic area on the glabellar region, were identified beside the other two-liner parallel and echogenic images corresponding to the skin interface right above the nasal bone.

Once the appropriate plane was identified, measurement of the nasal bonewas performed by placing the electronic calipers from the base of the nose closest to the frontal bone to the farthest extent of the ossification of the nose.

The sonographic identification of this feature has increased the detectionof 60% to 80% of DS foetuses,[4] with a false positive rate of 5%.[5]

The correct plane for the measurement of the fetal nasal length is illustratedin given below figure

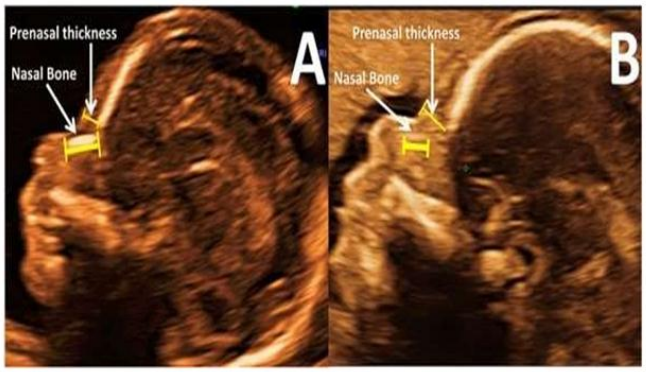


Figure 1: The anatomical structure of the fetal nasalbone length in Mid-Sagittal View.[6] Figure 2: Measurement of the fetal nasal bone length.[6]

The images shows the structure of the fetal image for the measurement of NBL in the mid-sagittal view. The fetal nasal bone can be visualized by sonography throughout pregnancy and the skin over the nasal bone, the nasal bone, and the skin over the nasal tip is generally used for identification.

3 echogenic lines can be visualized:- The first 2 lines, which are proximal to the forehead, are horizontal and parallel to each other, resembling an "equal sign".

The top line visualized on ultrasound represents the skin and the bottom one visualized, which is thicker and more echogenic than the overlying skin, represents the nasal

bone. A 3rd line, which is almost in continuity with the skin, but at a higher level,represent the tip of the nose.[7]

The NBL can be measured by the sonographers with electronic calipers from the base of the nose close to frontal bones to the farthest extent of ossification on the nose.

The measurement should be done carefully so that the echogenic skin surface is not mistakenly identified as a nasal bone.

Figure 3: Reference image for 2D visualization of nasal bone. Figure 4: Reference image for 3D acquisition of nasal Bone.

Figure 5: and 6: Reference image for 3D visualization of nasal bone.

Statistical Analysis

Descriptive statistical analysis was carried out for the study.

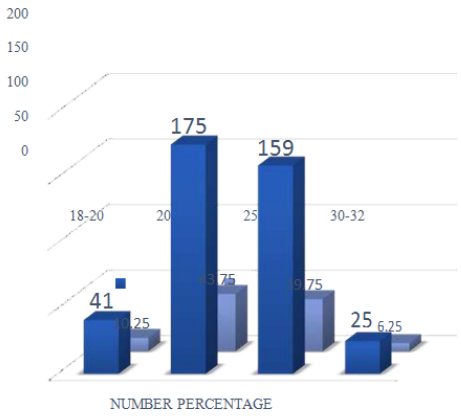
SPSS 15.0 software (IBM, Armonk, New York, USA) was used for the analysis of the data, and Microsoft Excel was used to generate tables andcharts.

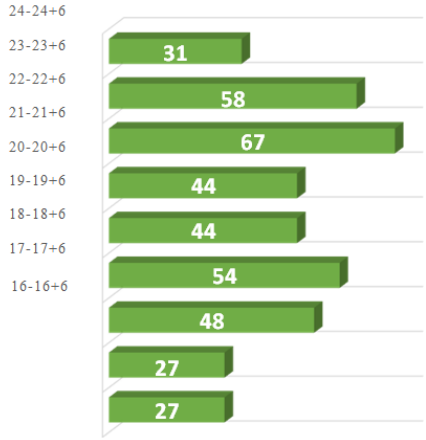
Results on categorical measurements were presented in numbers andpercentages.

Logistic Regression analysis was done at last in order to identify correlations between nasal bone length and gestational age

RESULTS

In our study, the most common involved patients were in age group of 20- 25 years with most common gestational age of 22weeks-22weeks+6days ofgestation.





Column Chart 1: Age Wise Distributionbar Diagram 2 : Gestational Age Wise Distribution.

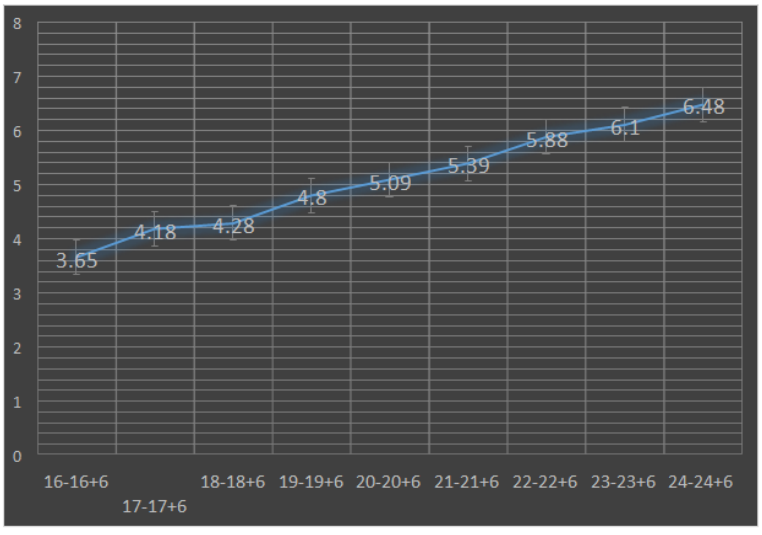
Table 1: Range of Nasal Bone Length.

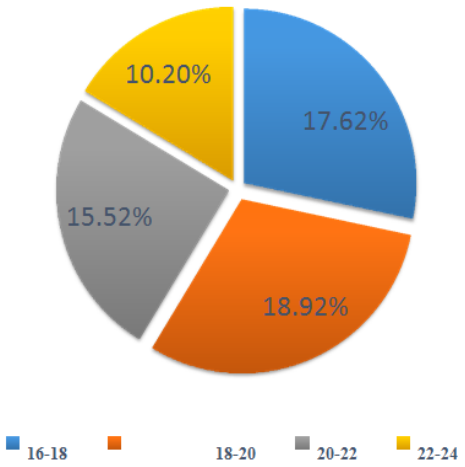
GESTATIONAL AGE GROUP (in weeks +days)	Nasal bone length minimum value	Nasal bone length maximum value
16-16+6	2.9	4.1
17-17+6	3.4	4.6
18-18+6	4.0	4.8
19-19+6	4.5	5.2
20-20+6	4.9	5.7
21-21+6	5.1	6.3
22-22+6	5.5	6.6
23-23+6	5.8	7.0
24-24+6	6.0	7.2

Table 2: Percentile of Nasal Bone Length

Gestational Age group (in weeks +days)	5th percentile ofnasal bone length	50th percent ile of nasal bone length (median)	95th percentileof nasal bone length
16-16+6	3.03	**3.8**	4.0
17-17+6	3.83	**4.2**	4.6
18-18+6	4	**4.2**	4.7
19-19+6	4.5	**4.8**	5.1
20-20+6	4.9	**5.1**	5.385
21-21+6	5.1	**5.3**	6.0
22-22+6	5.5	**5.9**	6.3
23-23+6	5.8	**6.1**	6.71
24-24+6	6.0	**6.4**	6.9

There is a linear increase in the nasal bone length and the maximum value of mean nasal bone length is found at 24-24+6 weeks of gestation with maximum percentage increase of nasal bone length in gestational age group of 18-20 weeks.

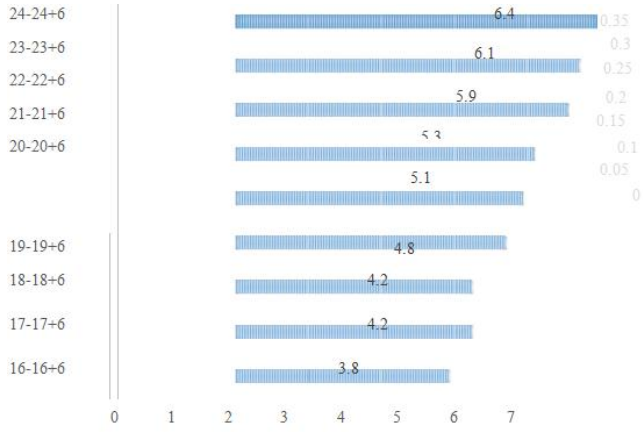


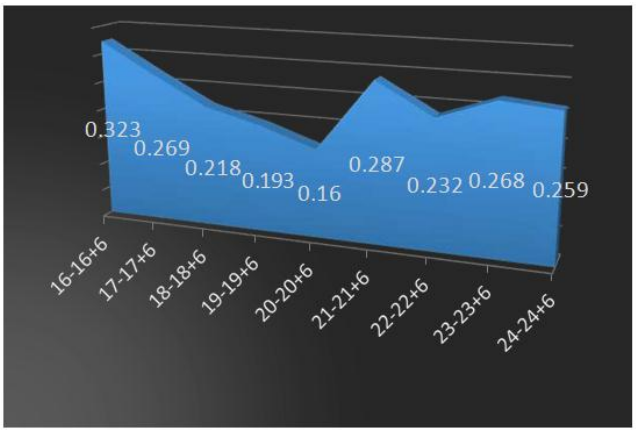


Line chart 3: Gestational Age v/s Mean Nasal Bone Length. Pie Chart 4: Percentage Increase of Nasal Bone Length.

The maximum 50th percentile obtained was 6.4 at 24 weeks-24weeks+6days ofgestational age.

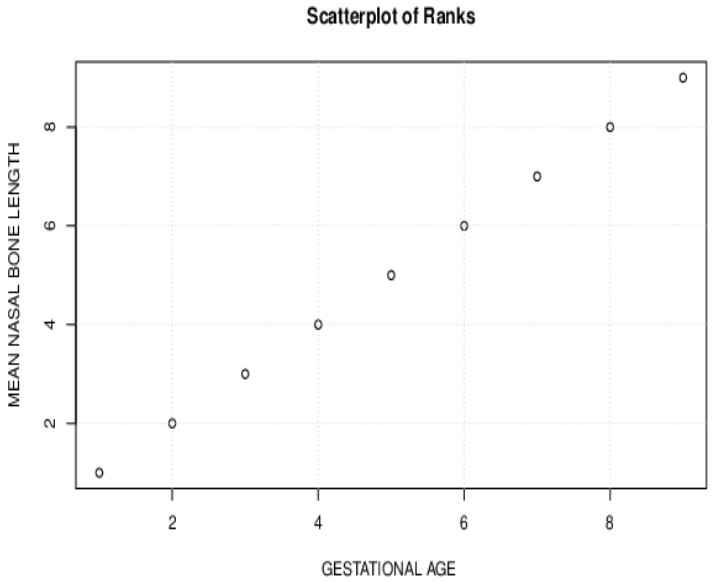
The maximum standard deviation of nasal bone length was 0.323 at 16 weeks-16weeks+6 days of gestation and minimum standard deviation obtained was 0.160 at 20weeks-20weeks+6 days of gestational age.



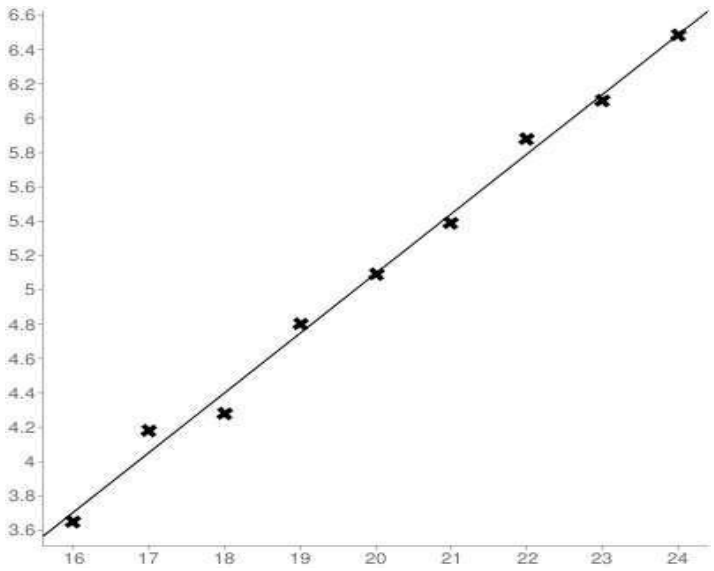


Bar Diagram 5: 50th Percentile of Nasal Bone Length. Area Diagram 6: Standard Deviation of Nasal Bone Length.

Spearman's correlation was applied to look for any correlation between the mean nasal bone length and the gestational age and a strong positive correlation was found between the two with Spearman rank correlation rho:1



Scatter Diagram 7: Gestational Age v/s Mean Nasal Bone Length.



DISCUSSION

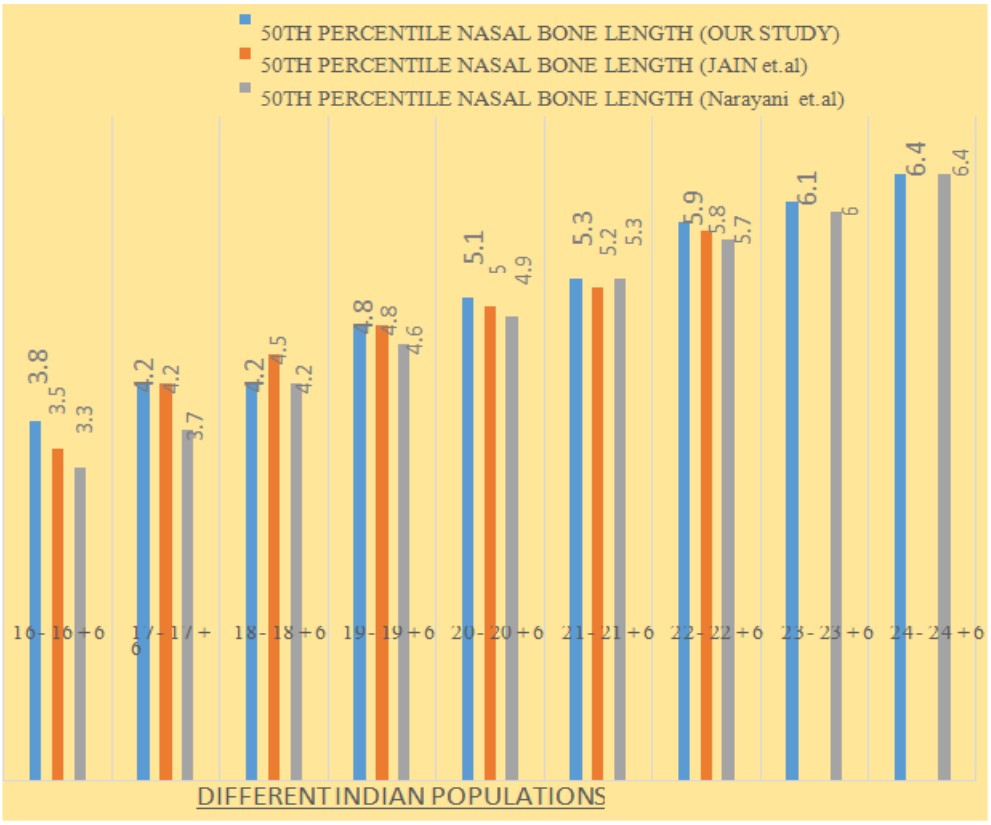
Nasal bone length is a strong marker scanned during the second trimester forthe screening of aneuploidies.

The nasal bones first appear at a crown-rump length (CRL) of 42 mm (11 weeks) as shown and confirmed by histological and radiological studies ofaborted fetuses.

Prenatal screening for fetal aneuploidies is not yet incorporated in our national health program, which means that the majority of the population isscreened for fetal chromosomal abnormalities mainly at the time of the anomaly scan.

Nasal bone length assessment remains a form of primary prenatal screeningin many of the Indian centers There is a difference in nasal bone length between race and ethnicityof different populations. This fact was supported by the study conducted by Bundeppa et.al.[8]

In comparision to other studies,the 50th percentile of nasal bone length was found to be almost similar to the study conducted by Jain et.al.[9] and Narayani et.al.[10] has done in 2060 and 2962 patients respectively, except that the values of our study were found to be insignificantly slightly.



Column Chart 8: Comparision of 50th Percentile of nasal bone length between.

Table 3: Comparision Of Mean Nasal Bone Length.

GESTATIONAL AGEGROUP (in weeks +days)	MEAN NASALBONE LENGTH (OURSTUDY) (mm)	MEAN NASAL BONELENGTH Sharma et.al2019
16-16+6	3.65	3.43
17-17+6	4.18	4.16
18-18+6	4.28	4.585
19-19+6	4.8	4.974
20-20+6	5.09	5.253
21-21+6	5.39	5.616
22-22+6	5.88	5.96
23-23+6	6.1	6.316
24-24+6	6.48	6.551

Similarly, compared to other similar studies conducted on Pan-Indian population, mean nasal bone length was found to be similar to the study conducted by Sharma et.al.[11] done in 6436 patients and was found to be slightly higher thanobtained in the present study after 17 weeks of gestation.

Out of 400 patients studied in the current study, the 50th

percentile of nasal bone length was found to be significantly lower compared to those conducted by Prabhu et.al,[12] seenesh et.al,[13] kashikar et.al,[14] Gupta et.al.[15] except that the value was slightly higher at 17weeks-17+6days and 18weeks- 18weeks+6days as compared to Kashikar et.al.[14]

Table 4: Comparision of 50th Percentile between Different Indian Population.

Gestational Age Group (in weeks +days)	50th Percentile Nasal Bone Length (OurStudy)	Prabhu et.al south Indian population	Seenesh et.al south Indian population	Kashikar et.al North Indian population	Gupta et.al North Indian population
16-16+6	3.8	5.5	N.D	N.D	5.40
17-17+6	4.2	6.0	N.D	3.70	5.80
18-18+6	4.2	6.3	4.52	3.90	6.30
19-19+6	4.8	6.6	4.755	5.40	7.10
20-20+6	5.1	6.8	5.25	5.80	7.50
21-21+6	5.3	7.2	5.78	6.70	7.90
22-22+6	5.9	7.4	6.525	7.00	8.30
23-23+6	6.1	8.0	N.D	N.D	8.80

Table 5: Comparision of 50th Percentile between Different Populations.

Gestational AgeGroup (in weeks +days)	50th PercentileNasal Bone Length (Our Study)	Kanagawa et al. Japanese population	Chen et al. Chinese population
16-16+6	3.8	3.5	4.1
17-17+6	4.2	4.5	4.6
18-18+6	4.2	4.9	5
19-19+6	4.8	5.2	5.6
20-20+6	5.1	5.8	5.8
21-21+6	5.3	5.7	6.2
22-22+6	5.9	6.6	6.7
23-23+6	6.1	N.D	N.D
24-24+6	6.4	N.D	N.D

Out of 400 patients studied in the present study, the 50th percentile was found to be quite significantly lower compared to the 50th percentile of different population-based study as conducted by Kanagawa et.al(Japanese population).[16] and Chen et.al(Chinese population).[17]

CONCLUSION

Our study of 400 patients resulted in linear relationship of fetal nasal bone lengthto weeks of gestation.

Study involving Indian North-Eastern population confirmed a close relationship with subtle differences between various Indian population based studies.

However there is a wide variation between Chinese and Japanese populations,suggesting the role of ethnicity.

Ultrasound being widely available, non-invasive, and rapid imaging modalityhelps in early detection of Downs syndrome.

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Nil.

Conflicts of interest
There are no conflicts of interest.

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