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Radiology

Sonographic Estimation of Gestational Age Using Mandible Measurement in Second and Third Trimester of Pregnancy

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Abstract		Original Research Article

This was analytical cross sectional study aimed to estimate the gestational age using fetal mandible length in second and third trimester by ultrasound. The problem of study was that lack of local previous studies regarding the topic, and in institutions there is no recommendation to include the fetal face in routine ultrasound screening during pregnancy. The study done in 114normal pregnant women in second and third trimester, the study was done in number of Khartoum hospitals (Alsaudi hospital, Professor Abd alsamad Mohamed Salih Center for Radiology and Ultrasound training and Chinese Sudanese Friendship Hospital) in period from February to august 2018. The study found that the fetal mandible length per millimeters equal gestational age per weeks, there was linear relationship between mandible length per millimeters and gestational age by last menstrual period, bi-partial diameter, femur length and abdominal circumference per week's age, there was strong signified correlation between them. Fetal mandible length increased by increasing of gestational age, mandible length per mm equal gestation age by Last Menstrual Period ($R2 = 0.999$), GA LMP = 0.998 ML+0.107, there was linear relationship between mandible length per mm and gestational age by Last Menstrual Period per weeks.The study concluded that Mandible Length per mm can be used as single parameter for estimation of gestational age. Viability of standard protocol for measurement of mandible length all obstetric departments and uses of international guidelines and protocol for scanning mandible length to give accurate result.
Keywords: analytical, millimeters and gestational, Gestational Age, Trimester of Pregnancy.

INTRODUCTION

Ultrasound is practically used in a majority of pregnancies, may be used to establish gestational age with greater accuracy than physical examination. In the first trimester, gestational sac mean diameter and crown- rump length measurements are the primary means of evaluating gestational age. In the second and third trimester, biparietal diameter, head circumference, abdominal circumference and femur length have been commonly used to estimate gestational age. Although numerous other parameters have been measured and related to gestational age, few offer any improvement in the accuracy of gestational age [1].

Sonographic assessment of the fetal face is an essential part of prenatal anatomical survey the deviation in maxillary and mandibular lengths is associated with multiple congenital anomalies. Short maxillary length may be related to a series of abnormalities, like Marfan syndrome, Trisomy 21. A short mandibular length also correlates with craniofacial malformations, cleft palate and trisomy 21. The sonographic diagnosis of micrognathia has been limited by the lack of an objective measurement of the fetal mandible [2].

The mandibular lengths are one of fetal organs always visible by Ultrasound examination in second and third trimester of pregnancy and in most cases it is Observable in its entirety, research on fetal mandibular growth basically correlate with the development of mandibular structures with fetal age, further studies were done on measurement of fetal mandible; in one of these studies the mandibular growth was lineary correlated with gestational age and BPD also the jaw index was validated as an objective tool for diagnosis of micrognathia in the fetus[3].

The purpose of this study is to use the ultrasound in assessment of fetal mandible measurement among population of healthy pregnant Sudanese women of Khartoum state and to determine if there is correlation in the mandible lengths and gestational age of their fetuses.

General objective

To estimate fetal gestational age during second and third trimester by ultrasound using mandibular measurement

MATERIALS AND METHODS

This was analytical cross sectional study done to estimate GA in second and third trimester using foetal mandible length. One hundred and fourteen pregnant women present for routine booking exam in 2nd and 3rd trimester (between 14 gestational weeks until terms), singleton gestation, normal viable fetus were selected using convention sampling technique with exclusion of first trimester, anomalous fetus, multiple pregnancy, any pregnant women of unknown LMP and Technically difficult.

The instruments use for this purpose was sonoscope 3.5 MHz curve linear and trance-vaginal transducer, Toshiba model with 3 trancedusers (curve linear, linear, phased array), Medison Model with trancedusers (curve linear and transvaginal). The data was collected by using data collection sheet include all parameters need for evaluation.

U/S was taken with the patient's in supine position. The patient's abdomen was smeared with U/S gel to remove the air interface between transducer and abdomen wall. During U/S procedure reading of biparietal diameter, femur length, abdominal circumference and mandible measurement wear taken using standerd methods. The fetus mandible measurement was obtained by moving the probe caudally from the plane of head circumference until the temporal-mandibular joint came into view .The probe was then rotate obliquely towards the fetus while the temporal –mandibular joint was fixed in view, the length of mandible was obtained by measuring from mandibular angle to symphysis menti.

RESULT AND DISCUSSION

Out of 114 normal pregnant women in second and third trimester, more than halve of them 52.6% in age group 26-36 years then 39.5%In age group 15-25years and 7% more than 36 years, 22.8 % gravida (1), 14.9% gravid (2) and (3) respective, 12.3% gravid (4) and 16.7% gravid (5), 24.6% para (0), 18.4% para(2) and 13.2% para (1)and (4) respectively. The study found that the mean BPD/ mm was 70.30±19.43, FL mm was 53.83±17.28, AC/ mm was 233±71.84, the GA LMP weeks range from 14.29-39 weeks, means 28.37±6.97, GA BPD/ WKs range from 14.57- 38.86, the mean GA BPD was 28.2±6.87 the range GA FL WKs 14.86-39.86, the mean GA FL was 28.91±7.61, the range of GA AC WKs 14.57-39.57, the mean was 28.38±6.87 , the range of ML 14.4mm-39mm, the mean was 28.32 mm. The study revealed that there was linear relationships between ML/mm and BPD mm (R2= 0.930), BPD mm = 2.68 ML /mm – 5.75 mm. This result agrees with study done by F M Lai ,GSH Yeo in Sengapore who Found that there is liner relation between gestational age using BPD and ML also agrees with the study done by I ng. Leun, ming-jie xang ...*et al.* in Taiwan, who state that there is linear relationship between ML gestational ages [4, 5].

The study found that there was linear relationships between FL/mm, and ML/mm (R2 = 6.94) FL/mm = 2.43 FL/ mm – 15.31 mm. This result agrees with study done by F M Lai ,GSH Yeo in Sengapore who Found that there is liner relation between gestational age using FL and ML also agrees with the study done by N.M. RoELFSMA: W.c.j Hop and j.w.w LADIM IROFF in Rotterdam, who state that there is liner relationship between ML gestational age[6, 5]. The study clarified that there was linear relationships between AC /mm and also This result agrees with by F M Lai ,GSH Yeo in Sengapore who found that there is liner relation between gestational age using GA ML/mm (R2=0.918) AC/mm = 9.86 ML – 45.5 mm. This result agrees with study done by F M Lai, GSH Yeo in Sengapore who found that there is liner relation between gestational age using AC and ML [5].

The study found that there was strong linear relationships between GA LMP / weeks and ML /mm (R2 = 0.998), GA LMP =0.998) , GA LMP = 0.998 ML+ 0.107, This result agrees with study done by Anjali G, Gosavi and sarita R. Margam who Found that there is liner relation between gestational age using gestational age and ML[6] and also This result agrees with e by F M Lai ,GSH Yeo in Sengapore who Found that there is liner relation between gestational age using GAThe study found that there was strong significant relationship between ML /mm and GA BPD(R2 = 0.991), GA BPD =0.981ML+0.501, This result agrees with study done by Ing .Leun ,ming-jie xang ….et in Taiwan, who state that there is linear relationship between ML gestational age and also This result agrees with the study done by F M Lai ,GSH Yeo in Sengapore who Found that there is liner relation between gestational age using GA BPD week and ML[4, 5].

The study reveal that strong linear relationship between GA FL week and ML/mm (R2 = 0.967), GAFL = 1.009ML + 0.339. This result agrees with the study done by N .M. RoELFSMA: W. c. j Hop and j w.w LADIM IROFF in Rotterdam, who state that there is linear relationship between gestational age using FL week and ML M Lai, GSH Yeo in Sengapore who found that there is linear relation between gestational age using FL week and ML [6, 5].

The study clarify also Linearity relationship between GA AC week and ML /mm (R2 = 0.986), GA AC = 0.978ML +0.688, this result agrees with the study done by N .M. RoELFSMA: W. c. j Hop and j w.w LADIM IROFF in Rotterdam, who state that there is linear relationship between gestational age using AC week and ML M Lai, GSH Yeo in sengapore who

Found that there is linear relation between gestational age using AC week and ML [6, 5].

The study found that was strong significant correlation between ML and GA MPL (R2 = 0. 999), p value less 0<0.01, ML and GA, BPD (R2 = 0.991) P value < 0.01), ML /mm GA FL (R2 = 0.967), P value <0.01) and ML /mm GA AC (R2 = 0.986) P value < 0.01).

No significant correlation between ML/mm parity and gravid p value > 0.05. there was Scatter Plot shows Linear relationship between fetal mandible length mm and GA LMP week (in study done by FM Lai, G S H Yeo in reference chart of fetal biometry in Asian 1998 – 2005 in 2029 from 6347 women included in study[5].

Table-1: Correlation between fetal mandible length and gestational age

|		gravidity	paraty	GALMP	GABPD	GAFL	GA AC
GALMP	Pearson Correlation	.135	.136	1	.995[**]	.983[**]	.993[**]
	Sig. (2-tailed)	.151	.148		.000	.000	.000
	N	114	114	114	114	114	114
GABPD	Pearson Correlation	.109	.111	.995[**]	1	.984[**]	.991[**]
	Sig. (2-tailed)	.248	.241	.000		.000	.000
	N	114	114	114	114	114	114
GAFL	Pearson Correlation	.097	.103	.983[**]	.984[**]	1	.978[**]
	Sig. (2-tailed)	.302	.273	.000	.000		.000
	N	114	114	114	114	114	114
GA AC	Pearson Correlation	.123	.126	.993[**]	.991[**]	.978[**]	1
	Sig. (2-tailed)	.193	.181	.000	.000	.000	
	N	114	114	114	114	114	114
MLmm	Pearson Correlation	.139	.140	.999[**]	.996[**]	.984[**]	.993[**]
	Sig. (2-tailed)	.141	.139	.000	.000	.000	.000
	N	114	114	114	114	114	114
**. Correlation is significant at the 0.01 level (2-tailed).							
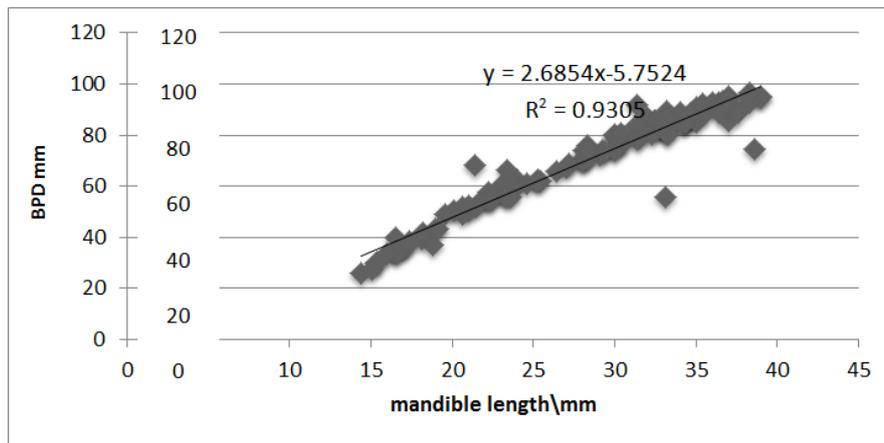
Fig-1: Scatter plot shows linear relationship between BPD mm and fetal mandible length mm
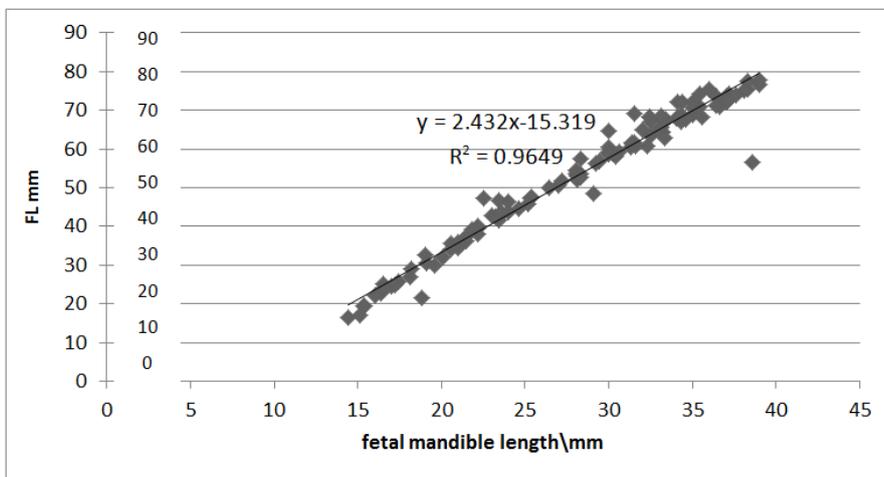

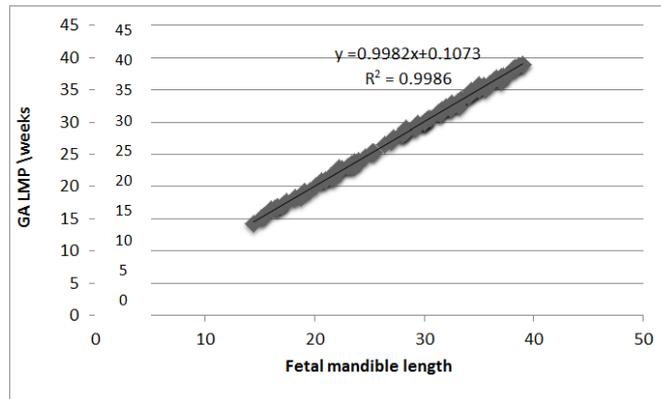**Fig-2: Scatter plot shows linear relationship between FL mm and fetal mandible length mm**

Fig-3: Scatter plot shows linear relationship between GA LMP and fetal mandible length mm
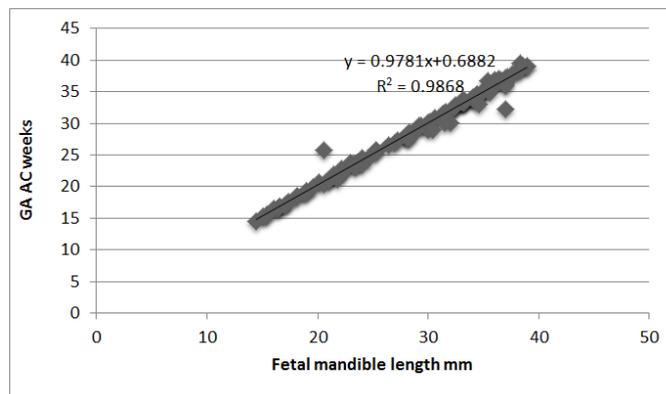

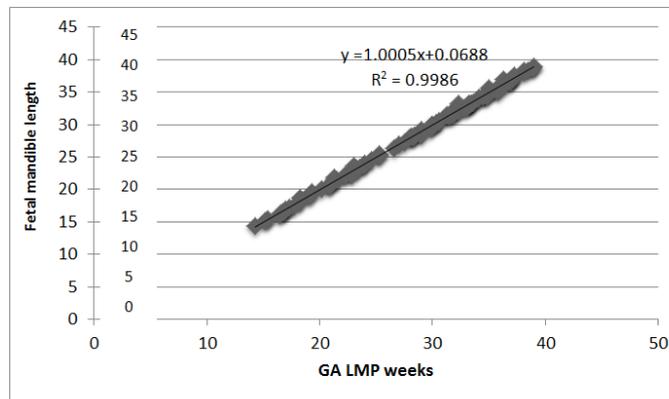**Fig-4: Scatter plot shows linear relationship between GA AC and fetal mandible length mm**

Fig-5: scatter plot shows linear relationship between fetal mandible length mm and GA LMP weeks
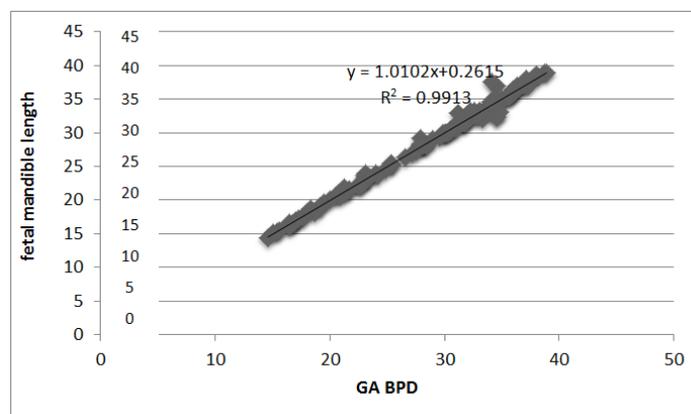

Fig-6: scatter plot shows linear relationship between fetal mandible length mm and GA BPD weeks
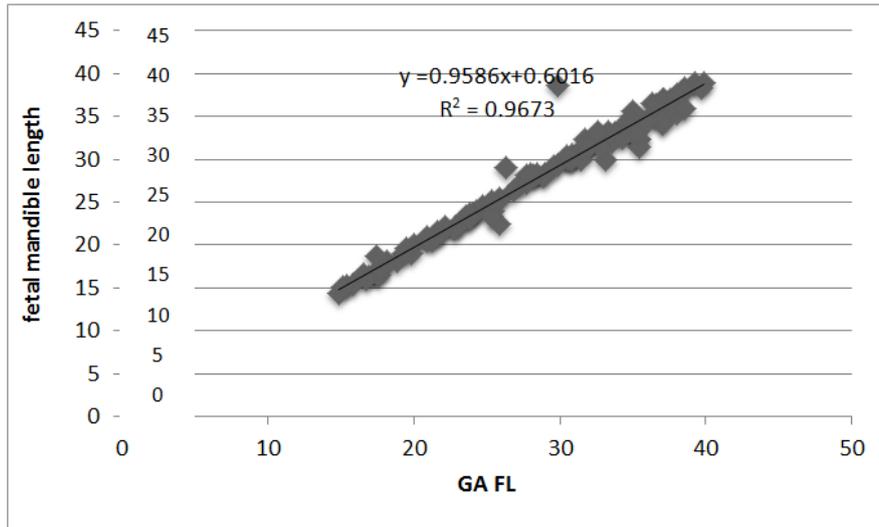
Fig-7: scatter plot shows linear relationship between fetal mandible length mm and GA FL weeks
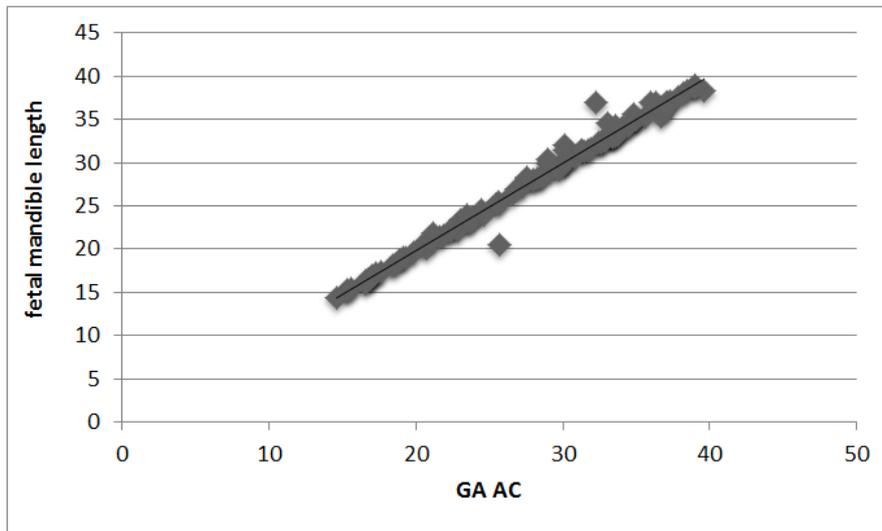

Fig-8: Scatter plot shows linear relationship between fetal mandible length mm and GA AC weeks
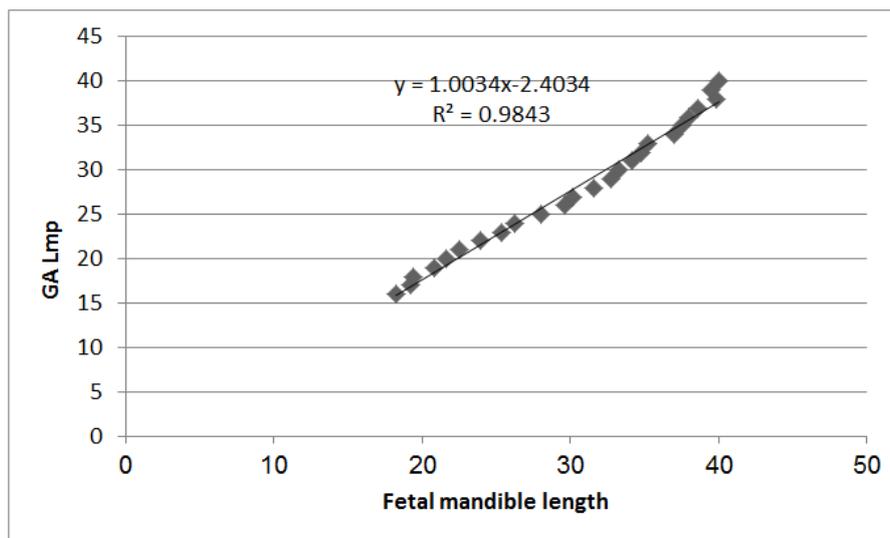

Fig-9: scatter plot shows linear relationship between fetal mandible length mm and GA LMP weeks (in study done by FM Lai, G S H Yeo in reference charts of fetal biometry in Asian 1998-2005 in 2029 from 6347 women included in study [14]
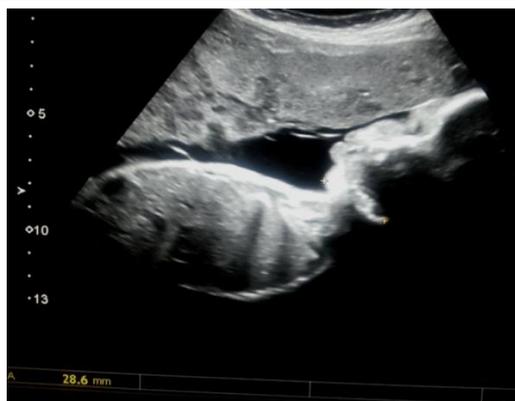
Fig-1: shows fetal mandible length at 36 years old, pregnant women with 28 weeks gestation ML= 28.6 mm. (Authuor Sorce)

Fig-2: Ultrasound image shows fetal mandible length at 21 years old, pregnant women with 24 weeks gestation ML= 24.5 mm (Authuor Sorce)

CONCLUSION

The study concluded that fetal mandible length increased by increasing of gestational age, mandible length per mm equal gestation age by Last Menstrual Period ($R2 = 0.999$), GA LMP = 0.998 ML+0.107, Bi-parietal diameter ($R2 = 0.991$), GA BPD = 0.981ML+0.501, Femur Length ($R2 = 0.967$), GA FL = 1.009ML+0.339 and Abdominal Circumference per weeks. ($R2 = 0.986$), GA AC = 0.978ML+0.688.

There was linear relationship between ML mm and GA per weeks. The study found there was significant correlation between Mandible Length per mm and gestational age by Last menstrual period, Bi-parietal diameter, Femur Length and Abdominal Circumference (P value < 0.01). The study concluded that Mandible Length per mm can be used as single parameter for estimation of gestational age.

RECOMMENDATIONS

Viability of standard protocol for measurement of Mandible Length in all obstetric departments. Using of mandible length international guidelines and protocol for scanning to give accurate result. Further studies should be done on this topic with large sample volume including First Trimester of pregnancy.

REFERENCES

1. Gabbe SG, Simpson JL, Niebyl JR, Galan H, Goetzl L, Jauiaux ERM. Obstetrics: Normal and problem pregnancies. 5th edition. London; Churchill Livigstone. 2007: 45-56.
2. Tsai MY, Lan KC, Ou CY, Chen SY, HsuTY. Assessment of facial features and chins development of the mandibular size monogram in Chinese population. Am J Obstet Gynecol. 2004; 190: 541-546.
3. Borenstein M, Persico N, Strobl I, Sonek J, Nicolaides KH. Frontomaxillary and mandibulomaxillary facial angles at 11 to 13weeks in fetuses with trisomy 18. Ultrasound Obstet Gynecol. 2007; 30:928.33.
4. Shyu L, Yang MJ, Wang HI, Wang PH, Chang CM, Juang CM, Chen YJ, Horng HC, Chen CC, Tseng JY, Sung PL. Fetal maxillary and mandibular length in normal pregnancies from 11 weeks' to 13+ 6 weeks' gestation: A Taiwanese study. Taiwanese Journal of Obstetrics and Gynecology. 2014 Mar 1;53(1):53-6.
5. Lai FM, Yeo GS. Reference charts of foetal biometry in Asians. Singapore medical journal. 1995 Dec; 36:628-36.
6. Roelfsema NM, Hop WC, Wladimiroff JW. Three-dimensional sonographic determination of normal fetal mandibular and maxillary size during the second half of pregnancy. Ultrasound in obstetrics & gynecology. 2006 Dec 1;28(7):950-7.
7. Gosavi AG, Margam SR. Analysis of growth of prenatal mandible by different parameters. Journal of the Scientific Society. 2013 May 1;40(2):76.