Original Research Article Journal of College of Medical Sciences-Nepal, Vol-16, No 3, Jul-Sep 2020

ISSN: 2091-0657 (Print); 2091-0673 (Online) **Open Access**
DOI: 10.3126/jcmsn.v16i3.28476

Placental Thickness: A Sonographic Indicator of Gestational Age in Normal Singleton Pregnancies in Nepalese Women

Prabhat Basnet,[1] Riddhi Adhikari[2]
[1]Department of Radiodiagnosis, College of Medical Sciences-Teaching Hospital, Bharatpur, Chitwan, Nepal.

ABSTRACT

Background: Presently the most effective way to date pregnancy is by use of ultrasound. Several sonographically derived fetal parameters used to date pregnancy include fetal crown - rump length (CRL), biparietal diameter (BPD), head circumference (HC), femur length (FL),and abdominal circumference (AC). Placental thickness measured at the level of the umbilical cord insertion can be used as a new parameter to estimate gestational age of the fetus. The present study was undertaken to evaluate the relationship between placental thickness and gestational age of the fetus. This study was aimed at estimating the (Placental Thickness) PT and at investigating the relationship between PT and the foetal growth parameters in normal singleton pregnancies.

Methods: A cross-sectional study was conducted in the College of Medical Science and Teaching Hospital, Bharatpur, Nepal among 150 patients with normal singleton pregnancies presenting for routine antenatal visit of all gestational ages from 11 weeks to 40 weeks. Patients with pregnancy induced hypertension, diabetes mellitus, intrauterine growth retardation, hydrops foetalis, congenital malformation and twins are excluded. Placental thickness value, in mm, was calculated by averaging the three best measurements for each case. We studied the relationship of placental thickness, in mm, measured at the level of insertion of umbilical cord with advancing gestational age in weeks. Correlation of mean placental thickness with gestational age from 11 weeks to 40 weeks was calculated.

Results: It was observed that the placental thickness gradually increased from approximately 11 mm at 11 weeks to 38.33 mm at 40 weeks of gestation. From 11 to 34 weeks of gestation, the placental thickness (in mm) almost matched the gestational age in weeks, thereafter from 35 to 40 weeks; the placental thickness was lower by 1 to 2 mm.

Conclusions: The relationship between the placental thickness and gestational age was linear and direct. Placental thickness (in mm) measurement can be an important additional parameter for estimating gestational age along with other parameters especially from 11 to 34 weeks of gestation. This was the first study for calculation of gestational age by measuring placental thickness in Nepalese women from Chitwan and this shall be an additional criterion for the assessment of gestational age of fetus along with other previously existing parameters such as femur length, biparietal diameter and abdominal circumference.

Keywords: gestational age; placental position; placental thickness; ultrasound.

INTRODUCTION

The placenta is a fetal organ with important metabolic, endocrine and immunologic functions besides being responsible for nutrition, respiration and excretion for the fetus. Lastly acting as a barrier, it has a role in protecting the fetus from noxious agents. Placental formation begins in the later half of the 2nd month of the pregnancy and is usually completed by the 4th month. It reaches its maximum growth at term.

The determination of the gestational age is a common clinical problem. Ultrasonography (USG) is commonly used to estimate the gestational age by measuring the foetal dimensions like the Biparietal Diameter (BPD), the Abdominal Circumference (AC), the Head Circumference (HC) and the Femur Length (FL). An ultrasonograph is prone to observer bias, as it depends on the observers' technical skills. Also, the foetal parameters, the different techniques of measurement and the positional problems may diminish the accuracy of the gestational age estimation. Wolfson et al., showed that the biparietal diameter was not reliable in the foetuses which had a premature rupture of the membranes There are some drawbacks in those above said parameters in estimating the gestational age. So, there is a need of another parameter for supplementing the gestational age estimation with minimal error. Nyberg and Finberg reported that the placental thickness parallels the gestational age.

Correspondence: Dr. Prabhat Basnet, Department of Radiodiagnosis, College of Medical Sciences, Bharatpur, Chitwan, Nepal. **Email:** pbasnet99@gmail.com. **Phone:** +977-9848023405. **Article received:** 2020-04-28. **Article accepted:** 2020-08-02.

METHODS

The present study was a cross-sectional study done in the College of Medical Science Teaching hospital, Bharatpur during the period of 1year (from December 2016 to December 2017) on 150 antenatal women who were referred for USG after ruling out maternal diseases. The ultrasonography machine which was used was Aplio 500 Toshiba with the use of a 3.5 MHz convex array transducer. Placental thickness, in mm, was measured at the level of cord insertion site. The transducer was oriented to scan perpendicular to both the chorionic and basal plates, as tangential scan will distort the measurement of the thickness of placenta.[8]

Inclusion Criteria: The normal antenatal women of all gestational ages from 11 weeks to 40 weeks of gestation referred to the department of Radiology, College of Medical Sciences, Bharatpur for routine antenatal ultrasound with known last menstrual period and with regular menstruation cycle.

Exclusion Criteria: Patients with PIH, diabetes mellitus, IUGR, hydrops foetalis, congenital malformations and twins were excluded from the study. Placenta with morphological variations in size and shape like lobed placenta, succenturiate lobe, placenta membranacea and circumvallate placentas as well as placenta with variation in insertions of umbilical cord like marginal or battledore placentas and velamentous cord insertions were excluded from study. Polyhydramnios where the large amounts of amniotic fluid can greatly increase the uterine volume and thus the surface area of placenta resulting in thinning of placenta and oligohydramnios were also excluded. Placentas with poor visualization of cord insertion site and also poor sonographic visualization of the placenta due to maternal obesity were also excluded from the study.

RESULTS

Gestational age

In this study conducted in 150 normal antenatal women the minimum gestational age was 11.57 weeks and the maximum gestational age was 40.00 weeks with a mean gestational age of 25.49 weeks and a SD of 8.00 (Figure 1).

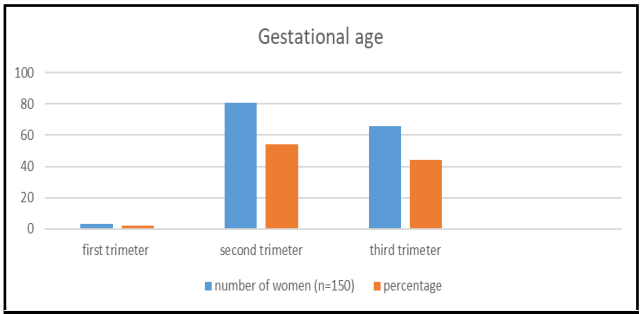

Fig 1. Gestational age at the time of examination. (n=150)

Placental position

Out of 150 normal antenatal women studied, anterior placenta was noted in 36%, posterior in 6%, fundal in 11% and lateral in 7% cases. Distribution of placental position is shown in (Table 1).

Table 1. Placental position distribution in ultrasonography

Placental Position	Number of women (n=150)	Percentage
Anterior	54	36%
Posterior	69	46%
Fundal	16	11%
Lateral	11	7%

Relationship between gestational age and placental thickness

Results of measurements of placental thickness at each week of gestational age from 11 to 40 weeks are shown in table 3. It was observed that the placental thickness gradually increased from approximately 11.00 mm at 11 weeks to 38.33 mm at 40 weeks of gestation. From 11 to 34 weeks of gestation, the placental thickness (in mm) almost matched the gestational age in weeks, thereafter from 35 to 40 weeks; the placental thickness was lower by 1 to 2 mm. At no stage of pregnancy was the normal placenta greater than 39 mm.

Pearson's correlation values between placental thickness and gestational age:

To prove that there was a correlation between placental thickness and the gestational age, the correlation coefficient was calculated. Pearson's correlation values between placental thickness and gestational age are shown below. In the second trimester, the Pearson correlation coefficient 'r' between placental thickness and gestational age was 0.914 and p value of <0.001 which was significant at 0.01 level.

In the third trimester, the Pearson correlation coefficient 'r' between placental thickness and gestational age was 0.946 and p value of <0.001 which was significant at 0.01 level. Overall, the Pearson correlation coefficient 'r' between placental thickness and gestational age was 0.984 and p value of <0.001 which was significant at 0.01 level. There was a significant positive correlation between placental thickness and, FL, BPD and AC in the second and third trimesters; with all parameters having identical relationships with placental thickness as shown in Fig 6, Fig 7 and Fig 8.

The Pearson Correlation coefficient 'r' between placental thickness and femoral length was 0.982 and p value of <0.001 which was significant at 0.01 level.

Table 2. Effect of advancing gestational age on placental thickness

Gestational age (weeks) According to Hadlock formula	Number of cases	Placental thickness in mm (mean ± SD)	95% Confidence interval (Lower-Upper)
11	1	11.00±00	-
12	2	12.00±00	-
13	6	13.55±0.80	12.91-14.19
14	3	13.89±0.19	13.67-14.11
15	7	14.95±0.30	14.73-15.17
16	9	17.92±4.94	14.69-21.15
17	4	17.08±0.16	16.92-17.24
18	11	18.39±0.62	19.02-19.76
19	6	18.83±0.91	18.12-19.56
20	8	20.25±0.61	19.83-20.67
21	4	21.25±0.32	20.94-21.56
22	4	21.83±0.19	21.64-22.02
23	3	22.78±0.69	22.00-23.56
24	5	24.53±0.69	23.93-25.13
25	3	25.00±00	-
26	5	26.07±0.15	25.94-26.20
27	0	-	-
28	5	28.27±0.59	27.75-28.79
29	3	29.22±0.69	28.44-30.00
30	6	30.22±0.40	29.90-30.54
31	4	31.00±00	-
32	9	32.33±0.98	31.69-32.97
33	9	32.63±0.98	31.99-33.27
34	12	34.05±0.66	33.68-34.42
35	6	34.72±1.02	33.92-35.54
36	6	35.72±1.10	34.84-36.60
37	4	35.67±0.94	34.75-36.59
38	2	36.16±1.64	33.89-38.43
39	0	-	-
40	1	38.33±00	-

The Pearson Correlation coefficient 'r' between placental thickness and abdominal circumference was 0.944 and p value of <0.001 which was significant at 0.01 level.

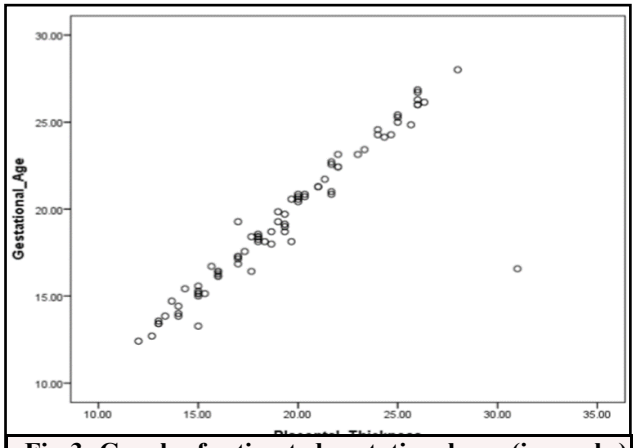

Fig 3. Graph of estimated gestational age (in weeks) against placental thickness (in mm) in the second trimester (n=82)

The Pearson Correlation coefficient 'r' between placental thickness and biparietal diameter was 0.981 and p value of <0.001 which was significant at 0.01 level

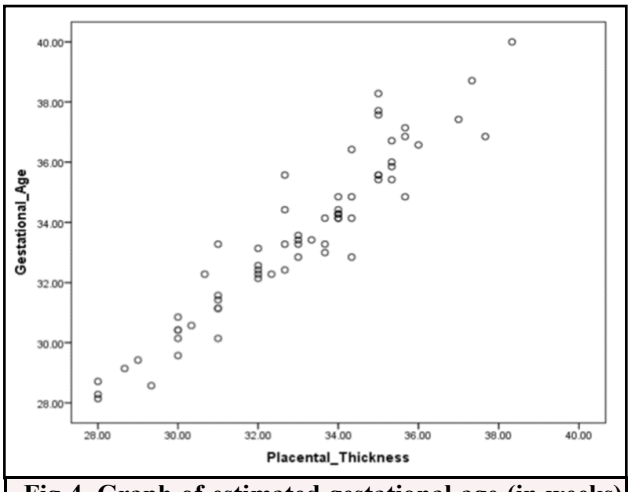

Fig 4. Graph of estimated gestational age (in weeks) against placental thickness (in mm) in the third trimester (n=66)

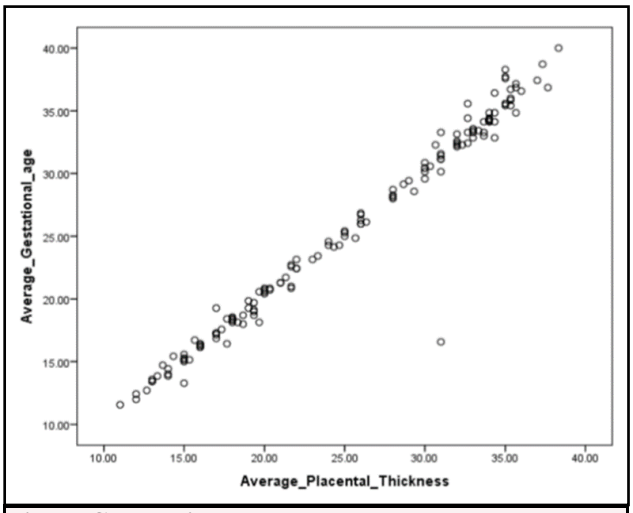

Fig 5. Correlation graph between average placental thickness (in mm) and gestational age (in weeks) (n=150)

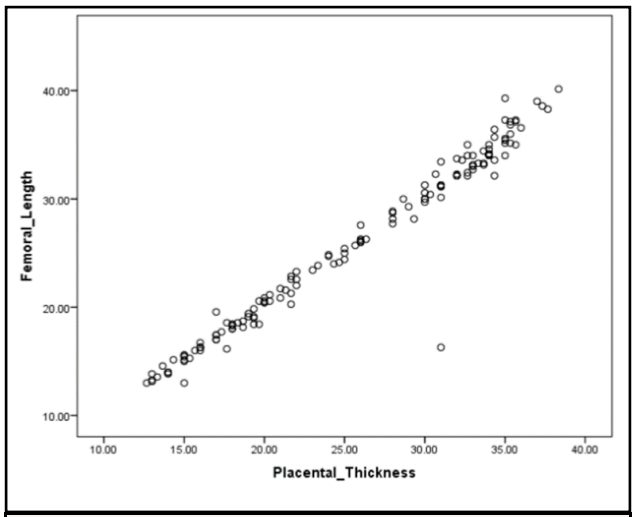

Fig 6. Graph of femoral length (in weeks) against placental thickness (mm)

DISCUSSION

The placenta is a materno-foetal organ which forms a little later than the foetus; it nourishes and protects the foetus and it dies out after the delivery of the baby. Since it is closely related to the foetus and the mother, it acts like a mirror, reflecting the statuses of both the mother and the foetus.

Donald introduced placental localization by ultrasound in 1965. This method of ultrasound placentography was found to be highly accurate for localization of placenta. Until recently, the placenta was evaluated purely to determine its position or to ascertain premature separation. A more detailed ultrasonography evaluation of the placenta has led to the understanding of possible morphologic changes as the placenta matures.

The present study assessed the relationship of placental thickness (in mm) with ultrasonographic gestational age (in weeks) and also the growth

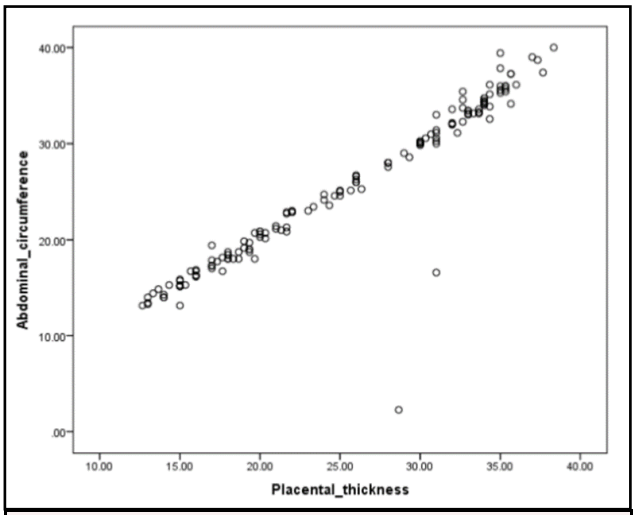

Fig 7. Graph of abdominal circumference (in weeks) against placental thickness (in mm)

pattern with advancing gestational age. The study showed that the placental thickness (in mm) increases steadily with increasing gestational age (in weeks) in a linear fashion and almost matching

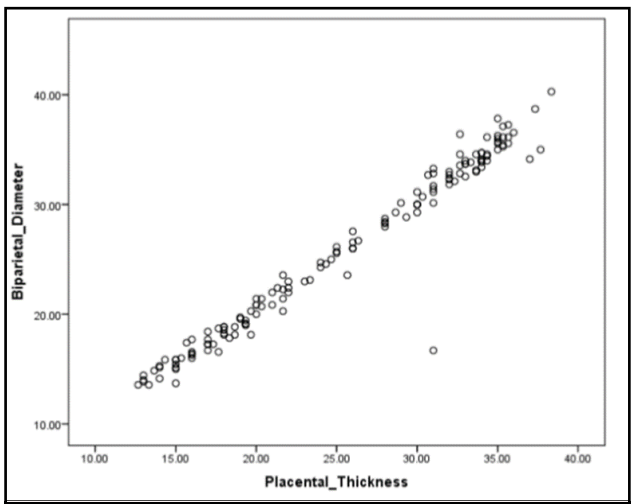

Fig 8. Graph of biparietal diameter (in weeks) against placental thickness (in mm)

the gestational age from 11 to 35 weeks of gestation. The rate of increase of placental thickness gradually diminished from 36 to 40 weeks and was less by 1 to 2 mm compared to gestational age (in weeks). To prove that there was a correlation between placental thickness and the gestational age, the correlation coefficient was calculated and it was found to be r= 0.914, r= 0.946 and r= 0.984 for the 2nd, 3rd and average trimesters respectively and the p value was < 0.001, thereby establishing a positive correlation between the two variables.

The results of the present study are consistent with the observations made by authors of previous studies. Hoddick et al. (1985) found average placental thickness (in mm) to be roughly equivalent to gestational age (in weeks). Mital et al.

(2002) also found an increasing trend in the values of mean placental thickness (in mm) with increase in gestational age (in weeks) and the placental thickness (in mm) coincides almost exactly with the gestational age in weeks. Jain et al. (2001) reported similar correlations between placental thickness and gestational age. They found placental thickness (in mm) almost matched gestational age (in weeks) from 27 weeks to 33 weeks of gestation. Grannum et al. (1982) reported that placental thickness would increase linearly until 33 weeks of pregnancy, after which there was gradual thinning. Nyberg and Finberg (1990) also reported that as a rule of thumb, placental thickness parallels gestational age (in weeks). Similarly in a recent study by Karthikeyan et al. (2012) had reported that placental thickness can be used as a predictor of the gestational age, in the women in whom the LMP is unreliable or is not known.

Foetal growth parameters such as BPD, and AC are used in the sonographic estimation of gestational age and weight of the foetus in the second and third trimesters**.** It is a standard practice to assess FL as part of the evaluation of foetal size and morphology. FL has been established as an accurate parameter for estimating gestational age in the second and third trimesters.[16] Present study showed a statistically significant positive correlation between placental thickness, FL, BPD and AC. This means that estimated foetal weight which is calculated based on a formula having FL, BPD and AC as variables is dependent on placental thickness.

Kulman and Warsoff (1996) stated that a placental thickness of < 25 mm at term, was associated with IUGR. A placental thickness of > 40 mm at term is associated with gestational diabetes, intra uterine infections and hydrops foetalis. It has been opined that at no stage of the pregnancy placental thickness exceeded 40 mm indirectly, thus indicating the cut off value for the upper limit. Among the pregnant women with CMV infections, the placental thickness was increased in about 93.3% of the subjects. Tongsong et al. (1999) in their study, found that the mean placental thickness between 18 to 21 weeks in normal pregnant women and in pregnancies with Hb Barts disease were 24.6±5.2 mm and 34.5±6.7 mm respectively.

CONCLUSIONS

Placental thickness measured at the level of umbilical cord insertion can be used as an accurate sonographic indicator in the assessment of gestational age in singleton pregnancies because of its linear correlation. Therefore, it can be used as an additional sonographic tool in correlating gestational age in cases where LMP is not known and in detecting patients developing IUGR.

REFERENCES

1. Rudy E Sabbagha, Diagnostic Ultrasound applied to obstructs and Gynecology, 2nd Edition Pg91-111
2. Holland and Brews, Manual of Obstetrics 16th edition, B L Churchill Livingstone pvt. Ltd 1998: 23
3. Cunningham FG, Gant NF, Leveno KS, Gilstap LC, Hanth JCWenstrom KD, in William Obstetrics, 21st Edition 2001, McGrewHill Pg 85-108
4. Malhotra N, Kumar P. Ultrasound in Obstetrics and Gynecology. 3rd ed. Mumbai: Jaypee Brothers Medical Publishers private Ltd; 1999. Chapter 11, Measurement of foetal parameters; chapter 27, Ultrasound and admission test in labour. Chapter 55, Pitfalls in USG;pp92-98, 198-200,386-88
5. Wolfson RN, Zador IE, Havorsen P, Andrews B, Sokol RJ. Biparietal diameter in premature rupture of membranes: Errors in estimating gestational age. J Clin Ultrasound. 1983; 11: 371-74
6. Nyberg DA, Finberg HJ. The placenta, placental membranes and umbilical cord. Journal on diagnostic ultrasound of foetal anomalies. 1990;21 (4) 623-75.
7. Jauniaux E, Ramsay B, Campbell S. Ultrasonographic investigation of placental morphology and size during second trimester of pregnancy. Am J Obstet Gynecol 1994; 170: 130-7
8. Hellman LM, Kobayashi M, Tolles WE, Cromb E. Ultrasonic studies on the volumetric gowth of human placenta. Am J Obstet Gynecol 1970; 108: 740-50.
9. Donald I. On lauching a new diagnostic science. AM J Obstet Gynecol 1968; 103: 609-28.
10. Hoddick WK, Mahoney BS, Callen FW, Filly RA. Placental thickness. J Ultrasound Med 1985; 4: 479-82
11. Mital P, Hooja N, Mehndiratta K. Plaental thickness-a sonographic parameter for estimating gestational age of the foetus. Ind J Radiol Imag 2002; 12: 553-4
12. Jain A, Kumar G, Agarwal U, Kharakwal S. Placental Thickness- a sonographic indicator of gestational age. J Obstet Gynaecol Ind 2001; 51: 48-9
13. Grannum PA, Hobbins JC. The placenta. Radiol Clin North Am 1982; 20: 353-65.
14. Nyberg DA, Finberg HJ. The placenta, placental membranes and umbilical cord. In: Newburgh DA, Mahoney BS, Pretorious DH, editors. Diagnostic ultrasound of foetal anomalies. St. Louis: Mosby year book publishers; 1990. P. 623-75.
15. Karthikeyan T, Subramaniam RK, Johnson W, Prabhu K. placental thickness and its correlation to gestational age and foetal growth parameters- a corss sectional ultrasonographic study. J Cli Dign Res 2012; 6:1732-5.
16. Benson CB, Doubilet PM. Foetal measurements: normal and abnormal foetal growth. In: Rumack CM, Wilson SR, Charboneau JW, Levine D, editors. Diagnostic ultrasound, 4th ed. Philadelphia: Elsevier;2011.p. 1455-71
17. Shepard MJ, Richards VA, Berkowitz RL, Warsof SL, Hobbins JC. An evaluation of two equations for predicting foetal weight by ultrasound. AM J Obstet Gynecol 1982; 142: 47-54
18. Kunlmann RS, Warsof S. Ultrasound of the placenta. Clin Afr J Obstet Gynecol 1996; 39: 519-34.

19. Benrishke K, Kaufmann P. Anatomy and Pathology of the umbilical cord and major foetal vessels. Pathology of the human placenta. 2nd ed. New York: Springer; 1998. p. 319-77
20. Abramowicz JS, Sheiner E. Ultrasound of the placenta: a systemic approach. part I: Imaging Placenta 2008; 29: 225-40
21. Tonsong T, Wanapirk C, Srisomboon J, Piyamongkol W, Sirichotiyakul S. Antenatal sonographic features of 100 alpha-thalassemia hydrosfoetalis fetuses. J Clin Ultrasound 1996; 24: 73-7
22. Tongsong T, Wanapirak C, Sirichotiyakul S. Placental thickness at mid pregnancy as a predictor of Hb Bart's disease. Prenat Diagn 1999; 19: 1027-30.

Citation: Basnet P, Adhikari R. Placental Thickness: A Sonographic Indicator of Gestational Age in Normal Singleton Pregnancies in Nepalese Women. JCMS Nepal. 2020; 16(3):122-7.