

Assessment of Fetal Biparietal Diameter, Femur Length and Abdominal Circumference in Local Population on Ultrasonography in Second and Third Trimester of Pregnancy

Femur Length,
Bi-Parietal
Diameter And
Abdominal
Circumference in
2nd And 3rd
Trimester

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ABSTRACT

Objective: To determine the normal reference range of femur length, bi-parietal diameter and abdominal circumference in duration of 2nd and 3rd trimester of pregnancy in local population.

Study Design: A cross-sectional analytical study.

Place and Duration of Study: This study was conducted at the Department of Anatomy / Community Medicine, at Bahawal Victoria Hospital, Bahawalpur from July 2020 to July 2021.

Materials and Methods: After taking approval from Institutional ethical review committee. All the pregnant women during 2nd and 3rd trimester of pregnancy with no known medical conditions, singleton fetus were included in the study. There were total 1,424 female participants in the study. Pelvic ultrasound was performed for evaluation of biparietal diameter, femur length and abdominal circumference by the consultant radiologist. Out of 1424, 484 were in 2nd trimester while, 940 were in 3rd trimester. For continuous variables, data was presented as mean standard deviation. Reported percentiles were 5th, 50th, 75th and 90th. SPSS version 25.0 was used for data analysis.

Results: The range of femur length was from 16 mm to 53 mm and 55mm to 79 mm in 2nd and 3rd trimester respectively. The range of fetal mean biparietal diameter (BPD) was 14-71mm and 74-98mm in 2nd and 3rd trimester respectively. The mean abdominal circumference (AC) ranged from 86-365mm at 14-41 weeks of gestation.

Conclusions: The study provided percentiles and normal reference range of femur length, bi-parietal diameter and abdominal circumference in duration of 2nd and 3rd trimester of pregnancy.

Conclusion: In our results we have given percentiles and normal reference line of femur length, abdominal circumference and biparietal diameter in 2nd and 3rd trimester of pregnancy in local population

Key Words: Fetus, Pakistan, pregnancy, Biometric charts, Femur length

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INTRODUCTION

Fetal biometrics, that differs based on ethnicity, is among the most crucial aspects of prenatal ultrasound. It is crucial for a monitoring study to evaluate the fetus's antenatal sonogram during a clinical checkup.¹ The criterion for fetal assessment is benchmark charts and formulas. For example, the use of fetal size benchmark charts and calculations would affect how fetal biometry was interpreted.²

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By taking into account local demographic features, community biometric charts satisfy the need for periodic adjustments of regular charts. An example would be a down psychosis soft indicator called shortened femur length (FL).³ Kovac et al., discovered lower-than-expected FL in an Asian populace.⁴ According to a different research, Chinese fetuses in Hong Kong had shorter FLs than those in the UK and France.⁵ It is unquestionably important to take ethnic divisions in fetal FL into account when screening fetuses for conditions like Down syndrome. Physicians mainly look for regular patterns of development and any thresholds that might indicate abnormal development.⁶ Fetal mass underneath the 10th or 5th percentile has been regarded as a fetal distress, as has a diameter far below 3rd percentile.^{6,7}

This research was conducted with the goal of providing biparietal diameter charts for local fetuses because there is currently no such chart available. In this manner, anomaly cases can be predicted with greater accuracy and practicality. The biparietal diameter (BPD) is one

of the most accurate 2nd trimester measures of gestational age. Measured from the beginning of the fetal skull to the inside aspect of the distal fetal skull ("outer to inner") at the level of the cavum septum pellucidum, this is one of the basic fetal measurements. The BPD can be used to determine gestational age with a 95% confidence of 10 to 14 days. If the gestational age is already known with precision (1st trimester ultrasound scan), then the BPD can be used to evaluate fetal growth. In cases of symmetrical growth retardation, the fetal BPD will fall below the 10th percentile. The abdominal circumference (AC) is a transverse section (coronal) through the fetal abdomen at the level where the umbilical vein enters the liver. The AC may be measured directly, or calculated from the AP and transverse abdominal measurements. Both techniques give good results. Although the AC can be used to calculate gestational age, it is more useful in determining fetal weight. Combined with the BPD, with or without the fetal femur length, reliable formulas can be used to predict fetal weight. The femur length can be used to determine gestational age, but it is more useful in helping evaluate fetal weight. It is also useful as a marker for fetal malformation and genetic abnormality. Many, though not all, trisomy 21 fetuses will have shortened femurs.^{8,9,10}

MATERIALS AND METHODS

It was a cross-sectional analytical study conducted at Bahawal Victoria Hospital, Bahawalpur during the months of July 2020 and July 2021. All the pregnant women during 2nd and 3rd trimester of pregnancy with no known medical conditions, singleton fetus were included in the study. Gestational diabetes mellitus, hypertension during pregnancy, congenital anomalies, and preceding premature birth were all exclusion criteria. Pelvic ultrasound was performed for evaluation of biparietal diameter, femur length and abdominal circumference by the consultant radiologist.

Informed consents are requested in every situation. An institutional ethical review committee had given its approval for the research. The distance between the forefront of the echo from the anterior fetal cranium and the top part from the proximal fetal skeleton was used to calculate BPD.¹ FL was taken on a plane that shows clearly the whole femoral distal end, including both edges at a 45° angle to the vertical. Abdominal circumference (AC), as explained by Campbell and Wilkin, was evaluated on the cross direction through the fetal stomach.⁸

By positioning the caliper close to the transmitter at the outer parts of the skeletal better functioning and the caliper further from the transmitter at the inner side of the skeletal calvarium, BPD and HC had been evaluated on a transverse picture of the gravid uterus at the tier of the partnered thalami, third left side of the heart, and cavum septum freely soluble.

For each case, information was gathered on the gestation, newborn age, BPD, AC, and FL. Version 25.0 of the SPSS was used to analyses all data. For continuous variables, information was shown as mean and standard deviation (SD). The 5th, 50th, 75th, and 90th percentiles had been revealed.

RESULTS

In this research, 1424 female participants were included. According to Tables 1 through 4, there were 484 pregnant women in their second trimester and 940 in their third trimester of pregnancy. From 27 to 98 mm has been the range for the mean BPD for fetuses with gestational ages with both 14 and 40 weeks. The mean AC in instances with weeks of gestation ages ranging from 14 to 41 mm. In our investigation, the average femur length varied between 16 and 53 mm in the second trimester of pregnancy and 55 and 79 mm in the third trimester of pregnancy.

In Figures 1–4, the average AC, FL, and mass for each gestational week has been displayed.

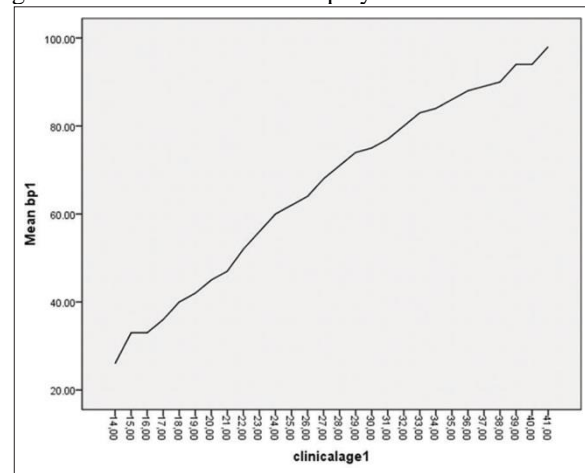
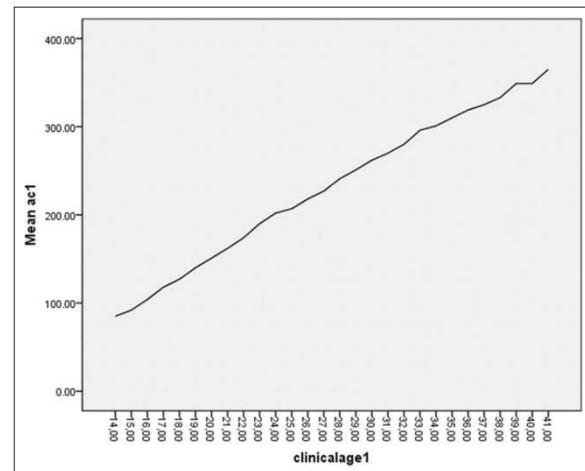


Figure No.1: Each gestational week's average biparietal diameter



**Figure No.2: Mean abdominal circumference of each gestational week
Each gestational week's average abdomen curvature**

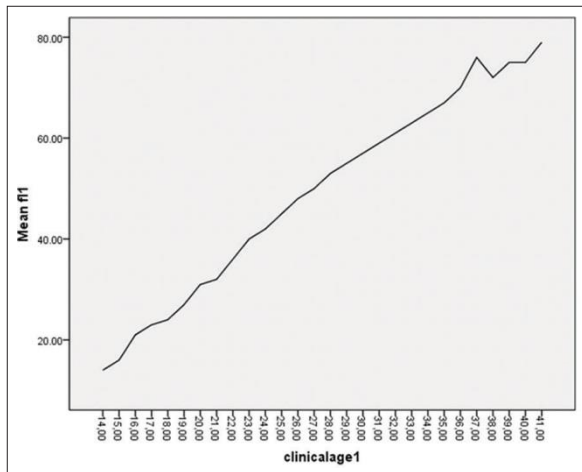


Figure No.3: The average femur size at each gestation

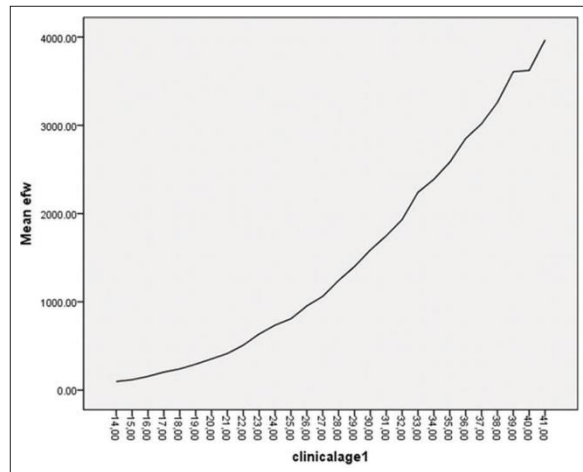


Figure No.4: The average weight within each gestational age

Table No.1: Values for biparietal diameter of different gestational ages

Gestational age	n	Mean ± SD	5 th percentile	50 th percentile	75 th percentile	95 th percentile
14	09	27±02	23.90	26.90	28.70	.
15	16	33.5±15.5	26.30	29.60	31.10	.
16	44	33.7±2.40	28.50	34.30	35.60	37.40
17	52	36.9±3.70	30.60	31.80	40	41.50
18	99	40±9.10	30.80	40.10	41.10	44.40
19	77	42.5±3.20	40	40.60	44.70	48.70
20	51	45±4.50	40.50	44.70	49.20	51.90
21	35	47±7.60	20.90	50	50.60	53.70
22	46	52.7±3.30	49.60	52.30	55.40	58.40
23	30	56.7±3.30	50.70	56.70	60.20	61.20
24	23	60.8±6.30	50.20	60.10	62.50	77.80
25	31	62.9±2.60	57.50	63.10	64.90	67.20
26	24	64.8±30	57	65.10	66.70	69.60
27	42	68.4±4.10	60.60	68.80	71.10	72.20
28	28	71.3±3.50	63.60	71.20	73.90	77.90
29	34	74±2.50	69.40	74.30	76.40	77.70
30	42	75.9±3.80	70.60	75.80	78.50	81.80
31	50	77.7±4.50	70.40	78.20	80.80	83.60
32	78	80.3±3.90	72.40	80.90	83	85
33	67	83±3.50	77.40	83.10	85.80	88.40
34	86	84.3±6.20	80.10	85.20	87	89.70
35	91	86.3±4.70	77.70	87	88.70	92
36	119	88.3±3.80	80.90	89	90.40	95.50
37	106	89.5±5.20	81.50	90.20	92.50	95.70
38	59	90.7±4.20	81.50	91.10	92.30	98.90
39	45	94±2.90	89.20	94.40	96.10	98.50
40	31	94±2.90	89.30	94.70	96	99
41	7	98.2±20	94.90	98	100	.

SD=Standard deviation

Table No.2: Values for abdominal circumference of different gestational ages

Gestational age	n	Mean ± SD	5 th percentile	50 th percentile	75 th percentile	95 th percentile
14	9	86.50±8.90	71.50	88.70	94.80	.

15	16	92±07.60	81.70	93.40	97.80	-
16	44	104.40±15.10	84.90	107.80	111.50	117.60
17	52	118.80±15.30	106.60	120.20	125.40	133.90
18	99	127.70±9.60	110.90	128.20	132.50	142.90
19	77	140.30±9.90	129.70	140.40	144.20	157.50
20	51	151.40±9.80	138	150.60	160.50	168.80
21	35	162.2±11.90	140.80	160.50	170.60	190.20
22	46	174.7±11.50	153.40	172.20	183.10	195.60
23	30	190.2±8.60	175	190.70	195.50	208.10
24	23	202.22.20	163.70	198.80	211	263.20
25	31	207.5±12.50	176.30	208	213.30	226.50
26	24	218.9±22.20	152.20	218.90	228.40	267.70
27	42	227.70±16	192.70	232.20	240.80	247.60
28	28	241.50±14	214.20	241.60	247.40	271.30
29	34	251.8±14.60	209.90	254.30	259.90	273.60
30	42	262.5±18.70	221.50	262.60	274.30	294.20
31	50	270.4±15.70	234	270.70	276.60	298.40
32	78	280.4±21.80	238.10	284	291.10	312.90
33	67	296.1±20.20	262.10	295.50	307.60	328.30
34	86	301.10±24.90	270.70	304.20	311.40	330.10
35	91	310.20±20.90	261.10	312	321.20	337.60
36	119	319±18.70	291.30	320.30	328.50	348.90
37	106	325.60±23	293.70	328.30	339.90	355.70
38	59	333.40±21.40	300.60	332.70	345.70	376.40
39	45	349.20±18.50	319.20	351.90	359.10	378.20
40	31	349.20±23.50	289.10	355.10	369.40	377.80
41	07	365.40±4.50	361.50	364.20	374.10	-

SD=Standard deviation

Table No.3: Values for femur length of different gestational ages

Gestational age	n	Mean±SD	5 th percentile	50 th percentile	75 th percentile	95 th percentile
14	9	14.9±1.80	11.30	15.60	16.20	-
15	16	16.4±1.90	12.60	16.70	18.10	-
16	44	21.8±12.40	13.40	20.40	21.60	23.90
17	52	23.1±2.50	20.20	23.40	24.80	28
18	99	24.2±3.70	20.40	23.80	27.10	30
19	77	27.4±4.30	20.70	29.40	30.10	33.50
20	51	31±2.50	28.40	30.30	32.40	36
21	35	32.1±6.50	17.40	32.50	35.50	40.70
22	46	36.9±04	30.40	38.40	39.70	42.10
23	30	40.8±2.60	35	40.30	42.50	44.80
24	23	42.6±4.70	31.70	42.20	43.90	54.10
25	31	45.1±2.90	40.20	45.50	47.80	49.70
26	24	48±4.90	31.20	49.80	50.50	51.90
27	42	50.7±5.40	41.20	50.50	53	55.90
28	28	53.1±3.40	44	53.90	55.30	57.70
29	34	55.2±2.60	50.10	55	57.90	59
30	42	57.20±4.5	46.8	57.8	60.3	62.7
31	50	59.10±3.60	50.30	60.20	61.30	63.30
32	78	61.70±4.20	54.20	62.30	64.10	67.20
33	67	63.70±3.10	57.30	64.30	65.70	68
34	86	65.80±5.3	60.30	66.30	68.70	69.90

35	91	67.40±04	60.60	68	70.10	72.80
36	119	70.10±2.9	65	70.30	71.70	75
37	106	76.50±59.20	64.80	71	73.20	75.50
38	59	72.30±3.40	66.30	72.70	74.90	77.70
39	45	75.20±02	71.30	75.70	76.80	77.80
40	31	75.20±03	72.10	75.30	77.10	80.50
41	7	79.10±1.70	77	78.50	80.90	

SD=Standard deviation

DISCUSSION

This research presents ranges for various biometric metrics for fetuses in 2nd and 3rd trimester of pregnancy in local population. Avoiding incorrect fetal abnormality diagnoses caused by the use of virtues from other populations is the aim of these calculations. Inappropriate complications and pointless procedures like amniocentesis might be avoided as a result of this.

For example, shortened bone and femur, that are present in Pakistani fetuses, is a sign of mental disabilities.¹¹ Femoral and humeral extents in Iranian foetuses with gestations ranging from 15 to 28 weeks were measured by Tahmasebpour et al. The femoral size varies from 18 to 52 mm on average (15– 28 weeks).¹¹ In our research, the average femoral size in the second trimester varied from 16 to 53 mm and in the third trimester of pregnancy from 55 to 79 mm. Our findings were in line with theirs.

Beige and Zarrinkoub measured FL and BPD of 15,693 of normal fetuses and reported mean BPD range from 28 to 93 mm for fetuses with gestational age between 14 and 40. In our study, mean BPD for fetuses with gestational age between 14 and 40 weeks was between 27 and 98 mm which were less than Western population.³

In 114 singleton deliveries with weeks of gestation ages ranging from 36 to 42 weeks, Kalantari et al. assessed BPD, AC, and FL. For BPD, AC, and FL, they provided mean values of 92, 336, and 73 mm (10). With gestational ages among 36 and 41, the average AC in our cases varied around 319 and 361 mm. The FL of Asian fetuses is smaller than that of white fetuses, according to previous findings from the Asian population.¹²⁻¹⁶ In addition to mean and standard deviation values, we noted frequencies and percentages of various biometrics in this research. According to the findings of various studies, the size and length of biometrics ought to be determined for every ethnicity in order to decrease medical error. In light of the variations among populaces, each community should employ its own comparison scopes. The biometrics of the fetus have been linked to equalization, tobacco use, mother tallness, mass, and ethnic group.¹⁵⁻²³ This research presents normal biometric ranges of local population that could serve as baselines for Pakistani fetal metrics. There were some limitations of this

research. It was not multicenter. Furthermore, the head circumference (HC) had been left out. Multicenter research is advised..

CONCLUSION

In our results we have given percentiles and normal reference line of femur length, abdominal circumference and biparietal diameter in 2nd and 3rd trimester of pregnancy in local population.

Author's Contribution:

Concept & Design of Sadaf Mushtaq
Study:

Drafting: Sidra Arshad, Lasania
Mushtaq

Data Analysis: Lasania Mushtaq, Hamad
Masood

Revisiting Critically: Sadaf Mushtaq, Sidra
Arshad

Final Approval of version: Sadaf Mushtaq

Conflict of Interest: The study has no conflict of interest to declare by any author.

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