

Ultrasound Fetal Femur Length in Normal Pregnant Northern Thai Women

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Abstract: *The measurement of fetal femur length (FL) in each week of pregnancy between the 14th and the 40th week was carried out at Maharaj Nakorn Chiang Mai Hospital from April 1989 to December 1990. A total of 1208 measurements were obtained from 435 patients, 203 patients had one measurement each and 1005 measurements were obtained from the remaining 232 patients. Growth of FL in the Thai population showed an asymptotic curve like that of Europeans or Americans but our values were significantly lower. The linear quadratic function was an accurate model describing the relation between femur length and menstrual age. Mean, standard deviation, 5th, 50th and 95th percentiles were calculated and predicted. FL for each menstrual week was also demonstrated. From the serial measurements performed, we found that the growth rate of the femur begins at 3.0 mm/week and slowly decreases to 1.3 mm/week toward 40 weeks of gestation. (Thai J Obstet Gynaecol 1991;3:79-83.)*

Key words: femur length, gestational age, pregnant Northern Thai women

Sonographic measurement of femur length as an indicator of menstrual age was first reported in 1981⁽¹⁾, and subsequently several investigators have used the fetal femur length as a predictor of menstrual age⁽²⁻⁴⁾. These studies have demonstrated that measurements of the fetal femur with ultrasound are very reproducible, probably because of the sharp bony margins. The primary objective

of the initial studies was to detect dwarfism prenatally, and several reports have confirmed the usefulness of this data in this regard^(5,6). Many reports have indicated that the variability in predicting menstrual age from femur length is actually less than that of biparietal diameter (BPD). Unfortunately, no report on the growth of fetal femur length in pregnant Thai women has been conducted, and there

are some evidences indicating that the birth weight of Thai babies is somewhat lower than those of Western ones^(7,8), therefore, we should accumulate our own data to have a standard value for further evaluation in Thai pregnancy.

Patients and Methods

The study included 435 pregnant Northern Thai women attending the antenatal clinic at Maharaj Nakorn Chiang Mai Hospital, Obstetrics and Gynaecology Department, Faculty of Medicine, Chiang Mai University, between 14-40 weeks. Each pregnancy was singleton, there was no medical, surgical or obstetrical complications during pregnancy. History of regular menstruation and exact date of last menstrual period was also noted, visit to antenatal clinic in first trimester and clinical estimation of gestational age agreed with menstrual age calculated from dates. Labour occurred within 14 days of expected date of confinement, and Dubowitz's scores confirmed this age. Maternal height of all these patients fell within the normal range for Thai women.

All femur length measurements were performed by two perinatologists, well-trained for obstetric ultrasound, using linear-array real-time system with 3.5 MHz focused transducer (Aloka, Model SSD 630, 650). The technique originally described by O'Brien and co-workers⁽¹⁾ was used to align the transducer along the longest axis of the femur. The long axis of the fetus was identified first, and the

transducer was then turned 90° to produce a cross-sectional image of the fetal trunk. The transducer was then moved down the fetus, maintaining this angle, to the fetal pelvis. Since the fetal femur is usually flexed, the transducer must be rotated 30° - 40° toward the fetal abdomen in order to visualize the long axis of the femur. Several femur length measurements were then made, and the longest measurement was considered optimal. Care must be taken to avoid tangential sections, which will foreshorten the femur, likewise, one must avoid including the ilium, ischium and distal femoral epiphyses, which will artificially lengthen the measurement. All measurements were made by using electronic calipers. The femur was determined in horizontal position in almost all cases, the maximum error in the lateral plane using the electronic calipers was 1%.

The perinatal sonographers did not know the menstrual age of the patients. Dubowitz's scores were assessed by only one pediatrician who had no any information about the obstetric data of the patients.

Results

A total of 1208 measurements of the fetal FL from the 14th to 40th week were taken in 435 patients, 203 patients had one measurement each, and the remaining 232 had serial measurements at least twice. The mean of FL for each gestational week and 2SD were calculated and the val-

Table 1 Mean fetal FL with 2SD, 5th, 50th and 95th percentile for GA

GA weeks	No.of exam.	Mean (cm)	2 SD (cm)	5th percentile	50th percentile	95th percentile
14	34	1.34	0.32	1.0	1.3	1.5
15	40	1.49	0.40	1.2	1.4	1.8
16	36	1.64	0.52	1.3	1.6	2.0
17	44	2.06	0.54	1.4	2.0	2.5
18	41	2.33	0.46	1.8	2.3	2.6
19	45	2.64	0.54	2.1	2.6	3.1
20	47	2.82	0.44	2.4	2.8	3.1
21	49	3.22	0.52	2.6	3.2	3.6
22	41	3.38	0.60	2.8	3.4	3.8
23	40	3.71	0.46	3.2	3.7	4.0
24	43	3.94	0.54	3.4	3.9	4.2
25	41	4.19	0.46	3.7	4.1	4.5
26	42	4.36	0.62	3.7	4.3	4.8
27	45	4.65	0.42	4.2	4.6	4.9
28	45	4.88	0.66	4.4	4.8	5.5
29	48	5.17	0.66	4.6	5.1	5.9
30	47	5.26	0.64	4.8	5.2	5.8
31	59	5.58	0.66	5.0	5.5	6.1
32	49	5.70	0.60	5.1	5.7	6.1
33	50	5.88	0.66	5.4	5.8	6.4
34	48	6.05	0.54	5.5	6.0	6.4
35	48	6.32	0.74	5.6	6.3	6.9
36	48	6.37	0.50	5.8	6.4	6.8
37	55	6.52	0.66	5.9	6.5	7.1
38	49	6.67	0.60	6.1	6.6	7.2
39	41	6.84	0.60	6.2	6.9	7.2
40	40	6.91	0.58	6.4	6.9	7.3

ues are shown in Table 1 and Figure 1. There was progressive linear increase from the first trimester towards term. In addition, 5th, 50th and 95th percentiles were also calculated, as shown in Table 1 and Figure 2. The linear quadratic function was an accurate model for describing the relation between femur length and gestational week ($r = .98$). The correlation between femur length and gestational age was formulated, $FL = -4.09575 +$

$0.42633(GA) - 0.00377304(GA^2)$ [GA = weeks of gestational age]. Comparison of mean FL (mm) for each gestational week between O'Brien's and this study was analyzed and showed that the femur length of pregnant Northern Thai women in this series was significantly lower than that in the Western series in almost all gestational age. The growth rate of the femur from serial measurement data has also been calculated, and found

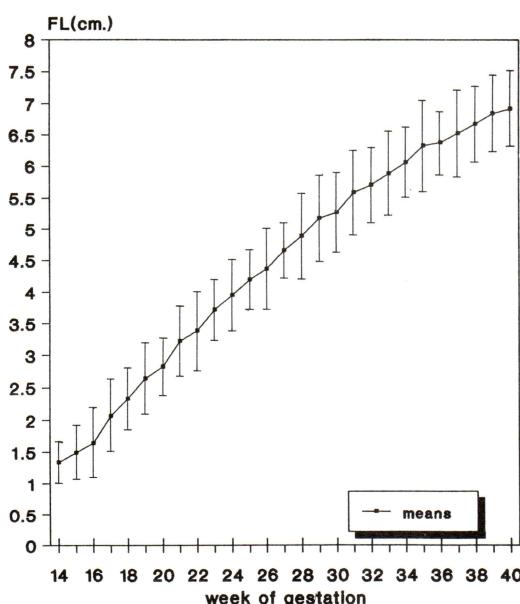


Fig. 1 Femur length and gestational age in normal pregnant Northern Thai women.

that growth rate begins at 3.0 mm/week and slowly decreases to 1.3 mm/week at 40th week of gestation.

Discussion

High-resolution real-time ultrasound now makes it possible to evaluate many physical parameters of the fetus. Fetal femur length measured by ultrasound provides another reliable parameter for the estimation of gestational age of the fetus. The value can serve as an alternative to the BPD measurement. Ideally, it will be used as an adjunct to BPD measurement, providing a more accurate evaluation.

Some investigators found that there may be race variations in true femur lengths that should be taken into account for prediction of gestational age⁽⁹⁾. For example, the value

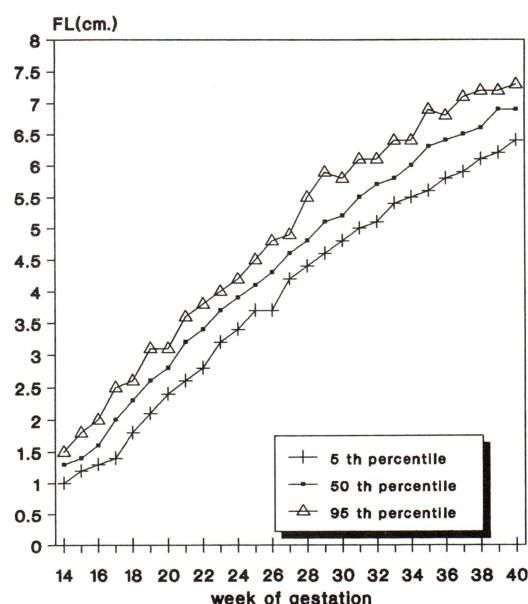


Fig. 2 Percentile chart of FL in normal pregnant Northern Thai women.

currently used to estimate menstrual age from femur length is based predominantly on the white Anglo-Saxon population. Hayashi⁽⁹⁾ has demonstrated that on average, fetuses of Latin-American origin have femur lengths that are somewhat shorter than those in the white Anglo-Saxon population. Pathologically, studies in adults indicate the possibility that some segments of the black population may have femurs that are on average longer than those observed in the White Anglo-Saxon population⁽⁹⁾. In comparison, mean femur length value of each gestational week in pregnant women from a Northern Thai population was quite different from those in Western reports^(1,2,10-12). The femur length values in our series agree with Hayashi's observation⁽⁹⁾, and are consistent with the fact that average birth

weight of a Thai baby is lower than those of the European or the American ones^(7,8). The difference of mean femur length values in our study and Western studies is most likely due to the racial factor.

Ultrasound fetal femur length values in the present study may be more appropriate for pregnant Northern Thai women than employing the European or American ones. In addition to estimating gestational age, fetal femur length may be useful as an adjunct in the diagnosis of some abnormalities, i.e. short limb syndrome or osteogenesis imperfecta.

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