



Promoting Excellence In Ultrasound

Policies and Statements

D7

Statement On Normal Ultrasonic Fetal Measurements

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June 1991, Reaffirmed May 1996, Revised May 2001

This policy implements a standard obstetric chart to ensure uniform reporting of obstetric measurements across Australia and New Zealand. The data used is based on the most recent research involving Australasian populations.

These charts are based on an Australian population. The figures were the result of a three year study of 3,800 pregnancies and 11,600 measurements of fetal parameters. 26 practices were involved with the project.

After the first trimester of pregnancy a multiparameter assessment of gestational age is advocated. This should include at least two fetal measurements (usually biparietal diameter (BPD) and femur length (FL)) plus a consideration of additional parameters such as head circumference (HC), occipitofrontal diameter (OFD), abdominal circumference (AC) and humerus length (HL).

Measurements in the beam axis are more accurate than those made across the axis. Despite this, some measurements (e.g. Crown-Rump Length (CRL) and femur length) should be measured across the axis.

The earliest measurement of gestational age taken in pregnancy should usually be accepted as the definitive assessment, subsequent examinations reflecting only fetal growth in the intervening period. If measurements taken after the first trimester are within one week of the gestational assessment taken from menstrual dating then the ultrasound assessment of gestational age confirms the menstrual dates. If the ultrasound measurements are in agreement and differ from menstrual dates by more than one week prior to 20 weeks a new estimated due date should be calculated and recorded. The reduced accuracy of prediction of gestational age after 20 weeks must be appreciated.

At any gestation, if the ultrasound fetal measurements of each parameter are not in agreement, the reason for this difference should be evaluated. This is preferable to just averaging all values to arrive at an estimated gestational age.

The wide normal range of BPD in late pregnancy must be appreciated. It is not expected that BPD be used to assess gestation late in pregnancy. The values from 33 weeks are intended to predict the growth in fetal head size from a known gestation.

Crown-Rump Length Measurements for an Australian Population					
Compiled by S Campbell Westerway ⁽²⁾					
Gestation (weeks/days)	CRL (mm)	Gestation (weeks/days)	CRL (mm)	Gestation (weeks/days)	CRL (mm)
5.2	1	8.3	20	11.4	52
5.3	2	8.4	21	11.5	55
5.4	3	8.5	22	11.6	56

5.5	3	8.6	22	12.0	57
5.6	4	9.0	23	12.1	58
6.0	4	9.1	24	12.2	60
6.1	5	9.2	26	12.3	61
6.2	6	9.3	27	12.4	63
6.3	7	9.4	28	12.5	64
6.4	8	9.5	29	12.6	65
6.5	9	9.6	31	13.0	68
6.6	10	10.0	34	13.1	70
7.0	11	10.1	36	13.2	72
7.1	11	10.2	37	13.3	74
7.2	12	10.3	38	13.4	76
7.3	12	10.4	39	13.5	77
7.4	13	10.5	39	13.6	80
7.5	14	10.6	40	14.0	81
7.6	15	11.0	44	14.1	84
8.0	17	11.1	45	14.2	85
8.1	18	11.2	47	14.3	86
8.2	19	11.3	48	14.4	87

Ultrasonic Fetal Measurement Standards for an Australian Population Compiled by S Campbell Westerway ⁽²⁾							
Gestation (weeks)	BPD (mm)	OFD (mm)	Head circumference (mm)	Abdominal circumference (mm)	Femur (mm)	Humerus (mm)	Gestation (weeks)
+/-2 standard deviations shown in brackets. Measurements are completed weeks.							
11	16 (2.0)	21 (2.0)	59 (15)	52 (10)	8 (2.0)	8 (3.0)	11
12	20 (4.0)	24 (2.0)	70 (15)	63 (10)	10 (2.5)	9 (2.0)	12
13	24 (4.0)	29 (3.0)	84 (15)	74 (10)	11 (2.5)	11 (3.0)	13
14	28 (4.0)	34 (3.0)	96 (15)	84 (10)	15 (3.0)	14 (4.0)	14
15	31 (4.0)	38 (3.0)	108 (15)	96 (10)	17 (3.5)	17 (5.5)	15
16	36 (5.0)	46 (3.0)	128 (15)	106 (10)	22 (4.0)	21 (4.0)	16
17	39 (5.0)	50 (3.0)	141 (15)	120 (15)	25 (4.0)	25 (5.0)	17
18	42 (4.0)	54 (3.5)	151 (20)	131 (15)	28 (5.0)	27 (5.5)	18
19	45 (5.0)	57 (3.5)	160 (20)	140 (15)	30 (5.0)	29 (5.0)	19
20	47 (4.0)	61 (3.5)	170 (20)	151 (15)	32 (6.0)	31 (5.0)	20
21	49 (4.0)	63 (4.0)	176 (20)	164 (20)	34 (6.0)	32 (6.0)	21
22	52 (5.0)	68 (3.5)	188 (20)	176 (20)	37 (5.0)	35 (6.0)	22
23	57 (5.0)	76 (4.0)	210 (20)	186 (20)	43 (5.0)	38 (4.0)	23
24	60 (6.0)	79 (4.0)	220 (20)	201 (20)	45 (4.0)	40 (6.0)	24
25	64 (6.0)	82 (4.5)	231 (20)	212 (20)	48 (5.0)	43 (5.0)	25
26	67 (4.0)	84 (4.5)	238 (20)	223 (25)	49 (5.0)	44 (4.0)	26
27	68 (5.0)	86 (4.5)	250 (20)	230 (25)	50 (5.0)	47 (4.0)	27
28	72 (4.0)	95 (5.0)	263 (20)	242 (25)	54 (4.0)	50 (5.0)	28
29	75 (4.0)	97 (5.5)	269 (25)	259 (25)	55 (5.5)	51 (5.0)	29
30	76 (4.0)	98 (5.5)	274 (25)	262 (25)	58 (6.0)	52 (5.0)	30
31	80 (6.0)	101 (5.0)	284 (25)	272 (30)	59 (5.5)	54 (5.0)	31
32	81 (4.0)	102 (5.0)	288 (25)	283 (30)	62 (6.0)	56 (5.0)	32
33	84 (6.0)	107 (5.5)	300 (25)	294 (30)	65 (4.0)	57 (6.0)	33
34	86 (6.0)	108 (5.5)	305 (25)	305 (30)	66 (4.0)	59 (5.5)	34
35	88 (6.5)	109 (5.5)	310 (25)	315 (30)	67 (6.0)	60 (6.0)	35
36	90 (6.0)	112 (5.5)	317 (25)	325 (35)	69 (6.0)	62 (5.0)	36

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37	92 (6.5)	113 (6.0)	321 (25)	333 (35)	72 (5.0)	63 (6.0)	37
38	93 (6.0)	116 (5.5)	328 (25)	342 (35)	73 (5.5)	64 (6.0)	38
39	95 (8.0)	119 (6.0)	336 (25)	356 (35)	75 (6.0)	65 (5.5)	39
40	96 (8.0)	120 (6.0)	340 (25)	362 (35)	76 (4.0)	66 (6.0)	40
41	98 (8.0)	122 (6.0)	344 (25)	367 (35)	77 (5.0)	68 (6.0)	41

CROWN-RUMP LENGTH

The CRL is measured between the fetal poles, excluding the limbs. The Campbell Westerway (SCW) charts differ from the previously recommended Robinson charts in pregnancies of less than 7 weeks.

The exception to the above recommendation is when using CRL in association with risk assessment for nuchal translucency. This applies only to those practices having access to the Fetal Medicine Foundation (FMF) Nuchal Translucency Risk Assessment Software. The FMF Software is based on the Robinson CRL charts and therefore the Robinson Charts should be used in this context. But in addition, gestation should still be reported based on the SCW charts.

The quadratic regression formula used to describe the relationship between CRL and gestational age is:

$$\text{CRL} = 0.5967 (\text{GA})^2 - 2.1413 - 3.4966 (r^2 = 0.985) \text{ and}$$

$$\text{GA} = -0.0007 (\text{CRL})^2 + 0.1584 (\text{CRL}) + 5.2876 (r^2 = 0.99)$$

BIPARIETAL DIAMETER AND HEAD CIRCUMFERENCE

The BPD and OFD are measured on a transverse axial section of the fetal head which includes the falx cerebri anteriorly and posteriorly, the cavum septum pellucidum anteriorly in the midline and the thalami. The BPD is measured from the outer edge of the nearer parietal bone to the inner edge of the more distant parietal bone. The OFD is measured perpendicular to the BPD. The SCW charts utilise the formula $\text{HC} = (\text{BPD} + \text{OFD}) \times 1.57$. In clinical practice if the ultrasound system has the facility to provide an ellipse measurement this is also acceptable.

The SCW BPD chart is not significantly different from the ASUM biparietal diameter chart adopted by ASUM in 1990.

The SCW HC chart is statistically different at a number of weeks of gestation to the Hadlock charts.

The quadratic regression formula used to describe the relationship between BPD, OFD, HC and gestational age are:

$$\text{BPD} = -0.0371 (\text{GA})^2 + 4.69 (\text{GA}) - 31.546 (r^2 = 0.969) \text{ and}$$

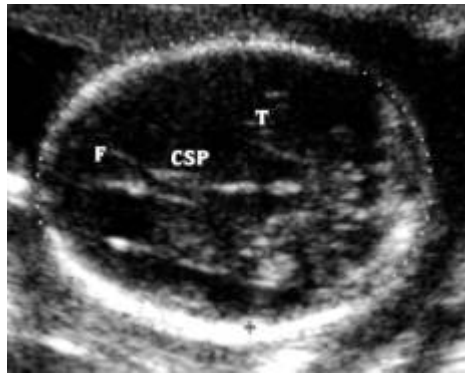
$$\text{GA} = 0.397 (\text{BPD}) - 0.00306 (\text{BPD})^2 + 0.00002788 (\text{BPD})^3 + 4.933$$

$$\text{OFD} = -0.0665 (\text{GA})^2 + 6.8881 (\text{GA}) - 49.08 (r^2 = 0.963) \text{ and}$$

$$\text{GA} = 0.381 (\text{OFD}) - 0.00344 (\text{OFD})^2 + 0.00002298 (\text{OFD})^3 + 4.189$$

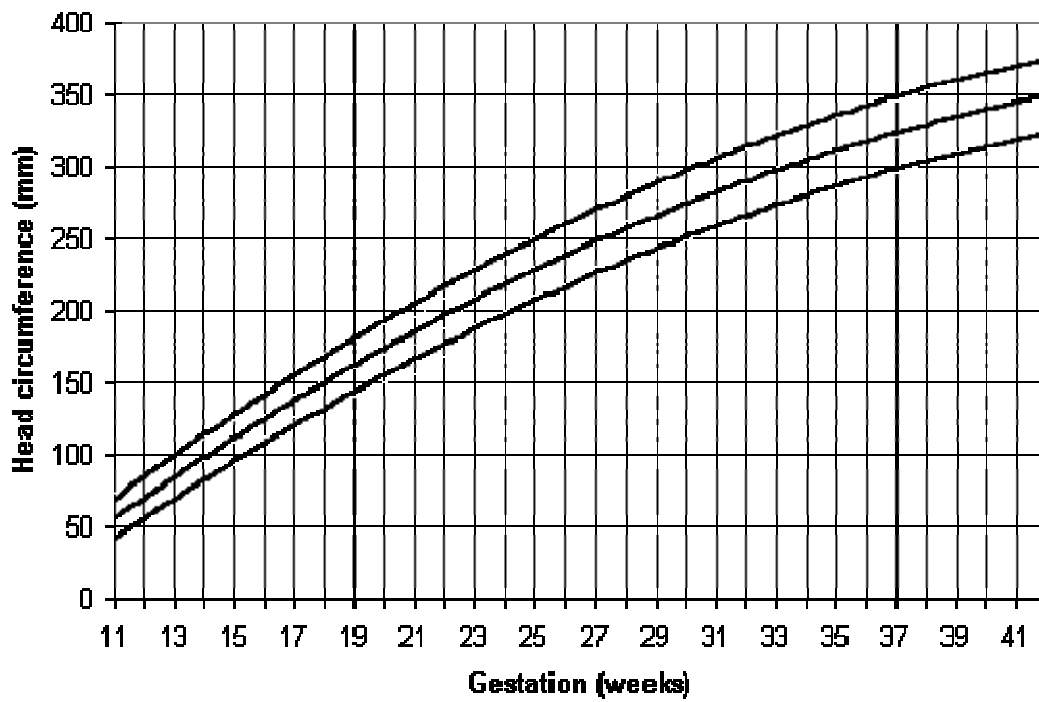
$$\text{HC} = -0.1699 (\text{GA})^2 + 18.494 (\text{GA}) - 127.91 (r^2 = 0.991)$$

$$\text{GA} = 0.0001797 (\text{HC})^2 + 0.02631 (\text{HC}) + 9.667 (r^2 = 0.996)$$

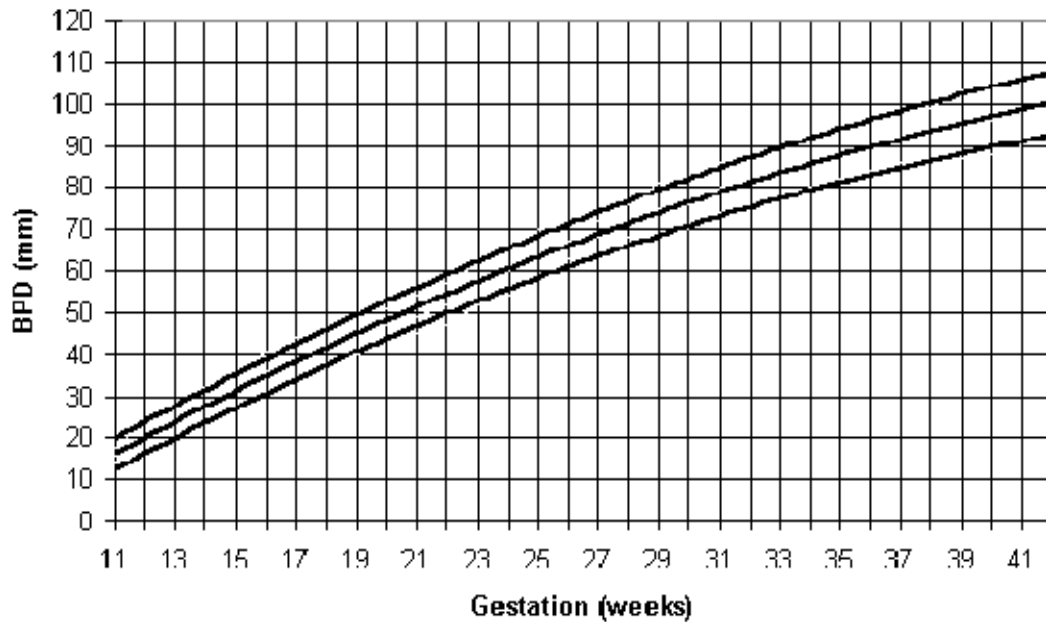


Biparietal diameter and head circumference measurements
 F = falx; CSP = cavum septi pellucidum; T = thalami

ASUM Head Circumference



ASUM Biparietal Diameter



FEMUR AND HUMERUS LENGTH

This is the first time the ASUM has specifically recommended a humerus length chart.

The long bones are measured with the bone across the beam axis. The strong acoustic shadow behind the femoral or humeral shaft and the visualisation of both cartilaginous ends indicates that the image plane is on the longest axis and is the optimal measurement plane. The calipers are placed along the diaphyseal shaft excluding the epiphysis.

The SCW chart is not statistically different from the Hadlock chart.

The quadratic regression formula used to describe the relationship between FL, HL and gestational age are:

$$FL = -0.0004 (GA)^3 + 0.0032 (GA)^2 + 3.1263 (GA) - 28.489 \quad (r^2 = 0.974)$$

$$GA = 0.41 (FL) - 0.002884 (FL)^2 + 0.00003924 (FL)^3 + 8.284$$

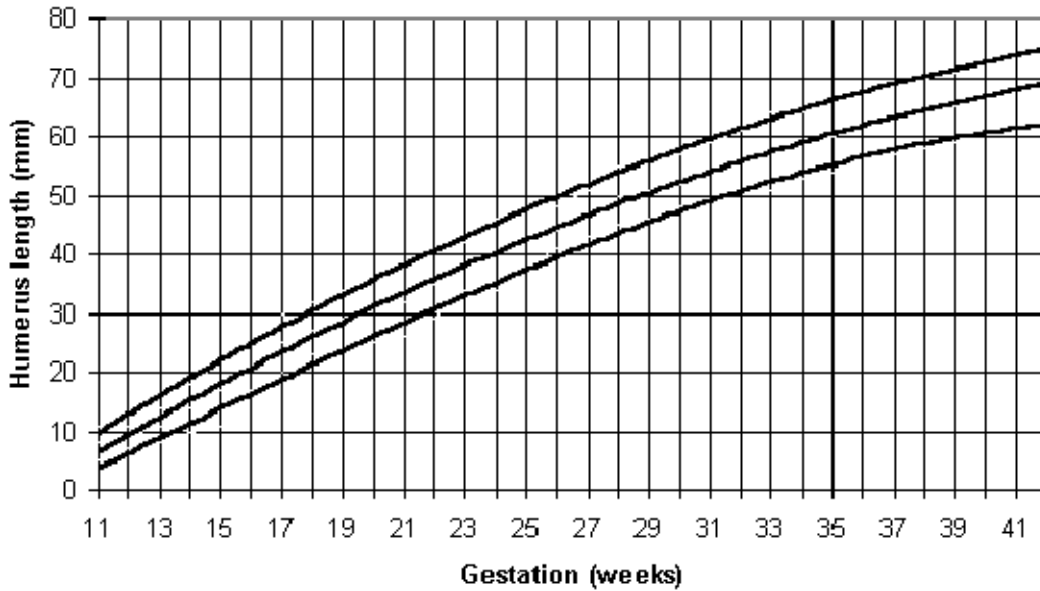
$$HL = -0.0001 (GA)^3 - 0.0235 (GA)^2 + 3.5386 (GA) - 29.452 \quad (r^2 = 0.956)$$

$$GA = 0.406 (HL) - 0.002804 (HL)^2 + 0.0000563 (HL)^3 + 8.411 \quad (r^2 = 0.999)$$



Humerus length measurement

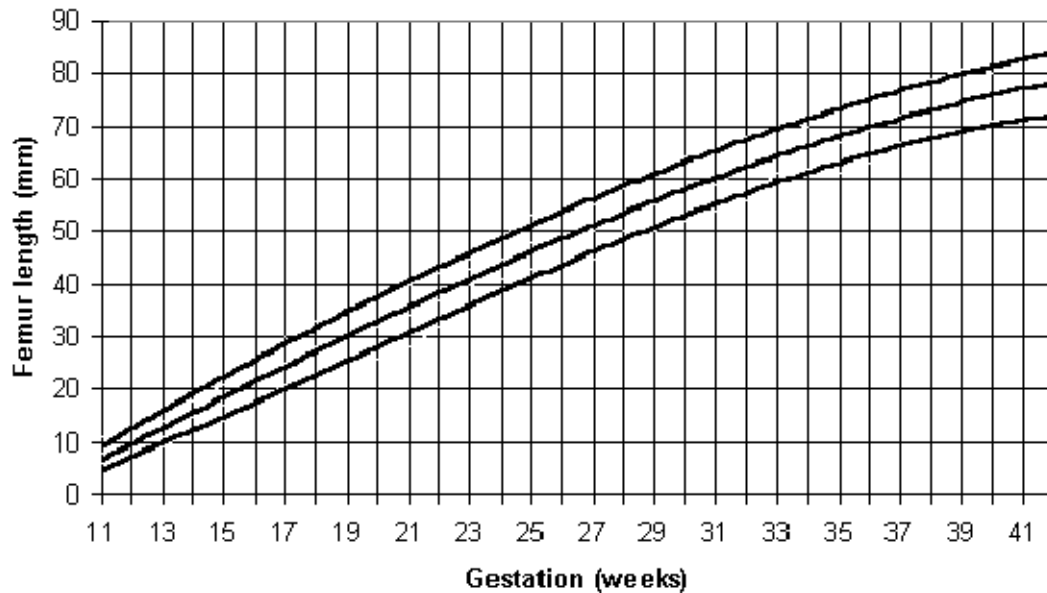
ASUM Humerus Length





Femur length measurement

ASUM Femur Length



ABDOMINAL CIRCUMFERENCE

These measurements are more appropriately used in the assessment of fetal growth, particularly in the second half of the pregnancy, than in the assessment of gestational age. It is, however, an appropriate measurement in the mid trimester to demonstrate normal fetal proportions.

The abdominal circumference is measured at the level of the liver and stomach, including the left portal vein at the umbilical region.

The SCW charts differ statistically from the previously recommended Deter charts.

The quadratic regression formula used to describe the relationship between AC and gestational age is:

$$AC = -0.0469 (GA)^2 + 13.204 (GA) - 90.946 \quad (r^2 = 0.984)$$

$$GA = 0.0000367 (AC)^2 + 0.07715 (AC) + 7.192 \quad (r^2 = 0.999)$$

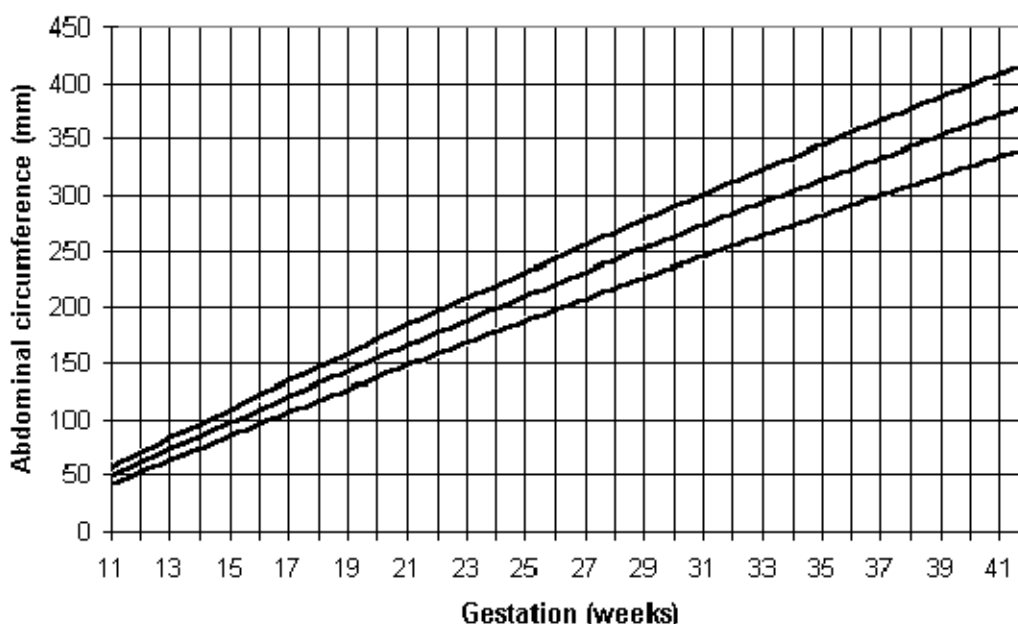
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Abdominal circumference measurement

SP = spine; ST = stomach; V = umbilical vein/portal sinus

ASUM Abdominal Circumference



FETAL WEIGHT

No formula for estimating fetal weight has achieved an accuracy which enables us to recommend its use. It should be noted that errors are reported for one standard deviation only and that even at this level the accuracy is disappointing. BMUS suggest that there may be an improvement in accuracy of about 5% in using two rather than one parameter.

REFERENCES

1. Clinical Applications of Ultrasonic Fetal Measurements, British Medical Ultrasound Society 1990 (available by writing BMUS, 36 Portland Place, London WN13DG).
2. Ultrasonic Fetal Measurements, 2000. S Campbell Westerway. ANZJOG 40(3), 297-302.
3. Deter R.L., Harrist R.B., Hadlock F.P. & Carpenter R.J., 1982. Fetal head and abdominal circumferences: 11. A critical re-evaluation of the relationship to menstrual age, Journal of Clinical Ultrasound, 10, 365-372.
4. Hadlock F.P., Harrist R.B., Deter R.L. & Park S.K., 1982. Fetal femur length as a predictor of menstrual age: sonographically measured, American Journal of Roentgenology 138, 875-878.
5. Hadlock F.P., Deter R.L., Harrist R.B. & Park S.K., 1982. Fetal head circumference: relation

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- to menstrual age. American Journal of Roentgenology 138, 647-653.
6. Edwards A, 2001. In the balance: the accuracy of sonographic estimation of fetal weight. ASUM Bulletin, 4(1), 3-6.
 7. de Crespigny L. & Spiers A.L.,1989. A new look at Biparietal Diameter. ANZJOG 29, 26-29.



Australasian Society for Ultrasound in Medicine
PO Box 943, Crows Nest NSW 1585, Sydney AUSTRALIA
Phone: +61 2 9438 2078 • Fax: +61 2 9438 3686
Email: asum@asum.com.au • Website: <http://www.asum.com.au>
ABN: 64 001 679 161