Analysis of fetal biometric measurements in the last 30 years

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Summary

Objectives. **To compare fetal biometric measurements with standard growth charts for ultrasound parameters existing from the last 30 years.**
Study design. **A preliminary prospective study.**
Setting. **Artemisia Mean Centre of Perinatal Diagnosis, Rome, Italy.**
Material and method. **A cross sectional study involving 1000 pregnant women with uncomplicated singleton pregnancy between 14th and 41th weeks of gestation from 1 January to 30 June 2008. All recruited pregnant women enrolled had an abdominal ultrasonography for fetal biometry. For each measurement, regression models were fitted to estimate the mean and SD.**
The results were compared with existing references from the last 30 years using Student's T distribution. Moreover, neonatal weights were obtained from 1977 to 2008 by ISTAT.
Results. **One thousand normal fetuses from pregnant women, between 22th and 23th weeks, between 32th and 33th weeks and at 38th week, were thoroughly measured. There were significant differences from the comparison with our data for each gestational age: femur length and homer length, abdominal circumference, head circumference and occipito-frontal diameter were longer than all parameters of existing references from the last 30 years. The analysis of neonatal weights on ISTAT data from 1977 to 2007 demonstrated a significant increment through the years.**
Conclusion. **Fetus is grown up across the years. It is necessary to modify the standard growth charts for ultrasound parameters existing from the last 30 years with actually fetal biometric measurements. It is helpful for a correct clinical approach and for an appropriate management mother-fetus.**

Sonographic determination of fetal size, for the purpose of gestational age determination or the detection of fetal growth anomalies is an extremely important part of modern prenatal care. Since a significant proportion of pregnant women are unsure of their last menstrual period, gestational age determination frequently relies solely on sonographic measurements of the fetal parts such as the biparietal diameter (BPD), occipito-frontal diameter (OFD), head circumference (HC), abdominal circumference (AC) and femur length (FL). Many variables affect fetal growth such as maternal illness, drug exposure, genetic syndromes, congenital anomalies, placental insufficiency and others. Previous reports have shown that ethnicity plays a role in fetal growth (1). Even within a population, geographical changes such as altitude can affect normal fetal size (2).
Thus, each particular population or ethnic group should have their own reference values for the different fetal anthropometrical variables in order to provide accurate assessments. So it is necessary to revise standard growth charts for ultrasound parameters edited in the years.
The aim of this study is to compare fetal biometric measurements with standard growth charts for ultrasound parameters existing from the last 30 years.

Material and method

A cross sectional study involving 1000 pregnant women with no history of drug, alcohol or tobacco use, no identifiable fetal anomalies, normal amniotic fluid certainty of last menstrual period and uncomplicated singleton pregnancy between 14th and 41th weeks of gestation from 1 January to 30 June 2008. All recruited pregnant women enrolled had an abdominal ultrasonography for fetal biometry. Fetal biometric measurements were recorded: biparietal diameter (BPD), occipito-frontal diameter (OFD), head circumference (HC), abdominal circumference (AC) and femur length (FL). For each measurement, regression models were fitted to estimate the mean and SD.
The results were compared with existing references from the last 30 years using Student's T distribution. Moreover, neonatal weights were obtained from 1977 to 2008 by ISTAT.

Results

One thousand normal fetuses from pregnant women, between 22th and 23th weeks, between 32th and 33th weeks and at 38th week, were thoroughly measured. The results for the measurements of the BPD, OFD, HC, AC and FL as a function of gestational age are presented in tables I through V.

There were significant differences from the comparison with our data for each gestational age: femur length and

Table I - Fetal biometric measurements at 22th gestational age.

Fetal biometric measurements	Study group (n = 240)	Standard value	*P value*	Interval confidence 95%
Biparietal diameter (mm)	55±0.001	54.7±6.3	P=0.461	Da -0.4991 a 1.009
Occipito-frontal diameter (mm)	67±0.001	65±7	P<0.001	Da 1.112 a 2.888
Head circumference (mm)	201.5±0.001	198±24	P=0.024	Da 0.4559 a 6.544
Abdominal circumference (mm)	173±0.001	158.25±6	P<0.0001	Da 13.99 a 15.51
Femur length (mm)	41±0.001	36±4	P<0.0001	Da 4.493 a 5.507

Table II - Fetal biometric measurements at 23th gestational age.

Fetal biometric measurements	Study group (n = 220)	Standard value	*P value*	Interval confidence 95%
Biparietal diameter (mm)	57.5±3.53	57.7±6.4	P=0.685	Da -1.168 a 0.7685
Occipito-frontal diameter (mm)	73.5±2.12	69±7	P<0.0001	Da 3.531 a 5.469
Head circumference (mm)	214.5±4.94	210±25	P=0.009	Da 1.123 a 7.877
Abdominal circumference (mm)	194.5±19.09	180±30	P<0.0001	Da 9.788 a 19.21
Femur length (mm)	42±0.001	39±4	P<0.0001	Da 2.47 a 3.53

Table III - Fetal biometric measurements at 32th gestational age.

Fetal biometric measurements	Study group (n = 170)	Standard value	*P value*	Interval confidence 95%
Biparietal diameter (mm)	82±0.001	80.3±6.6	P<0.0001	Da 0.7043 a 2.696
Occipito-frontal diameter (mm)	102±0.001	99±7	P<0.0001	Da 1.944 a 4.056
Head circumference (mm)	293±0.001	281±24	P<0.0001	Da 8.379 a 15.62
Abdominal circumference (mm)	277.3±0.001	270±20	P<0.0001	Da 4.283 a 10.32
Femur length (mm)	63±0.001	61±5	P<0.0001	Da 1.246 a 2.754

Table IV - Fetal biometric measurements at 33th gestational age.

Fetal biometric measurements	Study group (n = 247)	Standard value	*P value*	Interval confidence 95%
Biparietal diameter (mm)	83±4.24	82.4±6.7	P=0.235	Da -0.3913 a 1.591
Occipito-frontal diameter (mm)	104±2.82	102±7	P<0.0001	Da 1.057 a 2.943
Head circumference (mm)	309.5±10.6	305±24	P=0.007	Da 1.22 a 7.78
Abdominal circumference (mm)	298±5.65	280±0.30	P<0.0001	Da 17.29 a 18.71
Femur length (mm)	64.43±2.82	63±4	P<0.0001	Da 0.8182 a 2.042

Table V - Fetal biometric measurements at 38th gestational age.

Fetal biometric measurements	Study group (n = 143)	Standard value	*P value*	Interval confidence 95%
Biparietal diameter (mm)	94±0.001	91.4±6.8	P<0.0001	Da 1.481 a 3.719
Occipito-frontal diameter (mm)	113.5±3.53	112±7	P=0.023	Da 0.2096 a 2.79
Head circumference (mm)	339 +1.41	335±24	P=0.048	Da 0.04274 a 7.957
Abdominal circumference (mm)	342±36.76	320±20	P<0.0001	Da 15.11 a 28.89
Femur length (mm)	72.5±4.94	71±4	P=0.005	Da 0.4537 a 2.546

homer length, abdominal circumference, head circumference and occipito-frontal diameter were longer than all parameters of existing references from the last 30 years. The analysis of neonatal weights on ISTAT data from 1977 to 2007 demonstrated a significant increment through the years (3766±427 gr in study group versus 3445±377 gr sec ISTAT $p<0.05$).

Conclusion

For monitoring pregnancies it is useful to reduce unnecessary examinations due to wrongfully assumed growth retardation in cases with a small fetal growth potential. It also makes sense to improve the detection of objectively retardated children in order to a disproportionately high growth potential (3). Measurement was obtained 3 times by a certified experienced sonographist and the results were averaged. In order for a fetal sonographic evaluation to be reliable, the reference standards used should also be reliable and applicable to the population studied. Fetus is grown up across the years (4, 5). It is necessary to modify the standard growth charts for ultrasound parameters existing from the last 30 years with actually fetal biometric measurements. It is helpful for a correct clinical approach and for an appropriate management mother-fetus.

This study is a preliminary prospective study and it predates an Italian multicentric study just in progress. So it could be possible to construct new reference charts and equations for fetal biometry in the Italian population.

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