Fetal growth in Bogotá, Colombia: a comparison with international and latin american curves

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Abstract

Objectives: to describe estimated fetal weight, biparietal diameter, head circumference, abdominal circumference, and femoral length in a sample of pregnant women and to compare them with the international curves.

Methods: a retrospective cross-sectional study was conducted on ultrasonographic data of singleton pregnancies between 16 and 39 weeks in Bogotá, Colombia, from February 2015 to November 2018. Fetal parameters were evaluated. Descriptive analysis of each biometric parameter was performed, followed by comparison the curves provided by INTERGROWTH-21st and Lagos.

Results: a total of 1133 sonographic reports were analysed. The means ± SDs of biparietal diameter, head circumference, abdominal circumference, femur length, and estimated fetal weight measurements at 16 and 39 weeks were 34.7 ± 1.5 and 92.2 ± 4.4 mm, 122.2 ± 6.6 and 318.0 ± 17.0 mm, 107.2 ± 6.8 and 329.3 ± 34.6 mm, 20.6 ± 2.8 and 73.5 ± 3.3 mm, and 257.8 ± 20.9 and 3,115 ± 663.7g, respectively. The data were presented in graphs. AC and FL were the parameters that showed more statistically significant differences with international curves.

Conclusions: international reference charts analysed, show differences when fetal growth of this population was compared. The customized or local charts maybe are more useful to reach early detection of alterations of fetal growth in each population.

Key words *Fetal weight, Growth charts, Ultrasonography, Prenatal, Reference standards*

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Introduction

The evaluation of fetal growth (FG) through ultrasound is crucial in current obstetric practice. The alteration of fetal growth increases the risk of complications during pregnancy, childbirth and the neonatal period.[1,2,3]In 2000, Goodfrey, proposed that fetuses with growth alterations often exhibit changes in their physiology and metabolism, potentially predisposing them to chronic adult pathologies like hypertension, diabetes, obesity, and metabolic syndrome, among others.[4]

Fetal growth patterns (FGP) are influenced by fetal physiological and pathological characteristics, maternal factors, and the ethnic background or of the parents. All these variables contribute to significant variability in FG assessment, resulting in challenges in distinguishing between normal and pathological growth patterns.[1]

In current clinical practice, logarithmic regression equations are utilized for estimating fetal weight, which is incorporated into a formula.[5]However, its accuracy is not absolute, as the sensitivity and specificity of this method vary significantly across different formulas.[1,5,6]Hadlock's formula, introduced in 1985, is the most widely used formula globally for calculating estimated fetal weight (EFW). It incorporates parameters such as biparietal diameter (BPD), head circumference (HC), abdominal circumference (AC), and femoral length (FL), designed for application in a North American pregnant population with a 95% confidence interval and a 10% margin of error.[7]

Multiple charts for fetal and neonatal growth are utilized in clinical and research settings. This practice stems from the notion that each population should develop its standards, alongside discrepancies in the definitions of small for gestational age and intrauterine growth restriction.[8]For instance, in Latin America, studies have shown statistically significant differences in biometric data compared to Hadlock's standard, prompting the development of new formulas and charts tailored to local populations.[9] However, due to the lack of local studies to determine the normal FGP in Latin American populations, the Hadlock´s charts are often used.

Efforts towards standardization and homogenization of fetal growth curves led to the establishment of the International Fetal and Newborn Growth Consortium for the 21st Century (INTERGROWTH-21st) project in 2009to create international fetal growth standards.[8,10] In this study, fetal growth, and birth weight of the neonates whose mothers had the best environmental, social, and medical conditions during pregnancy were measured and they observed that when these conditions are ideal, fetal growth is extremely similar among the different regions. Additionally, through this project, a new formula to calculate EFW was created that allows to follow-up fetal growth closely.[10]

Similarly, in Colombia, initiatives like the Colombian Research group in Fetal Growth (CRGFG) have been established to develop fetal anthropometric tables and growth curves specific to the Colombian population.[11-13] Furthermore, in 2013, Briceño conducted a study in the city of Cali measuring a total of 792 fetuses whose data showed statistically significant differences with the date of Hadlock's charts.[14]The purpose of this study was to describe the EFW using the Hadlock's formula and the other biometric parameters in a sample of pregnant women of our population and to compare these measurements with the curves of INTERGROWTH-21st and the curves of Lagos, to determine whether there are differences.

Methods

This was a retrospective cross-sectional study of the data from the ultrasound reports of pregnant women from Bogotá with a singleton pregnancy and confirmed gestational age (by crown-rump length) between 16 and 39 weeks who attended the Ecodiagnóstico El Bosque Maternal-Fetal Medicine Unit between February 2015 and November 2018. Data from twin pregnancies, fetuses with major malformations, incomplete information and cases in which it was not possible to calculate gestational age by CRL at 11-13+6 weeks of gestation was excluded.

The following parameters were evaluated by ultrasound: biparietal diameter (BPD), head circumference (HC), abdominal circumference (AC), femoral length (FL), and the EFW calculated by Hadlock's formula. Measurements were made by a specialist certified in Maternal-Fetal Medicine following the recommendations of the guidelines of The International Society of Ultrasound in Obstetrics and Gynecology (ISUOG) and guidelines of The Fetal Medicine Foundation and using the GE Voluson™ E6 ultrasound device.[15,16]

For the BPD, an axial section of the fetal head at the level of the transthalamic plane was imaged, with a 90º of insonation angle, in which the cerebral hemispheres were observed symmetrical, hyperechoic middle line (falx cerebri) was interrupted by the

cavum septipellucidi, and the cerebellum was not visualized. Both callipers were placed from the outer edge to the inner edge in the widest part of the skull. For the measurement of the HC, in the same section of the BPD, the ellipse was placed around the echoes of the skull bone[15]or by measuring BPD and occipital-front diameter.[16]The measurement of BPD can also be taken in the transventricular plane with the technique outer edge to outer edge in terms of the location of the callipers or in the axial plane as described by Campbell and Thoms.[17]

To measure the AC, a cross-section of the abdomen was taken as circularly as possible, where the umbilical vein at the level of the portal sinus and the stomach bubble could be seen, and kidneys could not be seen. If the ellipse was used, the callipers were placed on the outer surface of the skin line, if not, the AC was calculated from the measurements of anteroposterior and transverse abdominal diameters. To measure these diameters, the callipers were placed on the outer edges of the contour of the body, where the widest point of the fetal abdomen was observed, then it was calculated by the formula: $AC = \pi$ (APAD + TAD) / 2 = 1.57 (APAD + TAD).[18]

To measure the length of the femur, the view was made where the two ends of the ossified metaphysis were observed with angle of insonation of 30º. The callipers were placed at the ends of the ossified diaphysis without including the distal femoral epiphysis if it was visible, and the measurement excluded artefacts that can falsely extend the femur length.[15] In advanced gestational ages, measurement was made from the greater trochanter of the femur to the lateral condyle.[19]

A descriptive analysis of each ultrasonographic parameter (BPD, HC, AC and FL) was made. Atypical data were identified and reviewed. The meanand standard deviation were calculated to include the data in a graph with a representation of the 3rd, 50th and 97th centiles of the INTERGROWTH-21st project and the 10th, 50th, and 90th centiles of Lagos. The distribution of each parameter in each gestational week was evaluated by the Shapiro-Wilks test and D'Agostino's K^2 test and then these parameters were compared with the reference values of 50th centile of INTERGROWTH-21st project and of Lagos, by Student's t-test and Wilcoxon signed-rank test. A value of $p<0.05$ was considered statistically significant.

Ethical approval was obtained by *Ad-Hoc Ethics* Committee of El Bosque University, Nº 12239 of April 02, 2014 (Approve in Session Number 9 of June 27, 2019), and Fundación Salud Bosque, Clínica El Bosque (Number 05-473-19).

Results

For this study, 1150 ultrasound reports were obtained. However, 17 ultrasound reports were excluded since showed atypical data by the following specifications: typing errors in the report (n=3), stillbirth (n=1), fetal macrosomia (n=1), severe oligohydramnios (n=1), and other malformations (n=11).Therefore, in this study, data from 1133 ultrasound records were considered. The mean maternal age was 28.6 years (standard deviation 6.2), 70.9 % of patients (n=471) were from the mixed ethnic origin, the mean BMI at the first trimester was 24.6 kg/m^2 (standard deviation 3.9), and the mean BMI at the third trimester was 27.6 kg/m^2 (standard deviation 3.8). Allthe patients, 22.7% (n=151) were primigravidas. Only 4.9% of the studied pregnant women (n=33) were obese, and 5.1% (n=34) had low maternal weight. Only one patient had antiphospholipid antibody syndrome (APS), and none had systemic lupus erythematosus (SLE).

The clinical and sociodemographic characteristics of the mothers evaluated are summarized in Table 1. Additionally, distribution of the ultrasonographic measurements, the mean and standard deviation for each of the biometrics parameters and EFW per week are shown in Appendix 1.

The Figures 1 and 2 show the diagrams of box and whisker plots of the EFW and the data of each of the biometric parameters per week of the fetuses in this study.

The graphs of the estimated fetal weight of our data compared with the 3rd, 50th and 97th centiles of the INTERGROWTH-21st project and with the 10th, 50th and 90th centiles of Lagos, are shown in Figure 3; and the distribution of each of the biometric parameters compared with the 3rd, 50th and 97th centiles of the INTERGROWTH-21st project and with the 10th, 50th and 90th centiles of Lagos, are shown in Figure 4. The 3rd and 97th centiles of the INTERGROWTH-21st project and the centiles 10th and 90th of Lagos, are represented by black lines and dots and the 50th centiles of the INTERGROWTH-21st and Lagos, are represented by the gray lines and dots. The means ± SDs of the biparietal diameter, head circumference, abdominal circumference, femur length, and estimated fetal weight measurements at 16 and 39 weeks were 34.7 ± 1.5 and 92.2 ± 4.4 mm, 122.2 ± 6.6 and 318.0 ± 17.0 mm, 107.2 ± 6.8 and 329.3 ± 34.6 mm, 20.6 ±

Table 1

Maternal clinical and socio-demographic characteristics. Bogotá, Colombia, 2015 to 2018.

Characteristics	N	%
Maternal age (years) (x̄± SD)	28.5 ± 6.3	
Ethnicorigin		
White	12	1.8
Black	8	1.2
Mixed	471	70.9
Unknow	173	26.0
BMI (kg/m²) (x̄± SD)		
I trimester	24,6 ± 3.9	
II trimester	26.0 ± 3.8	
III trimester	27.6 ± 3.8	
Primigestant	151	22.7
Comorbidities		
Diabetes Mellitus	3	0.45
ChronicHypertension	9	1.3
Obesity	33	4.96
Chronic Renal Failure	4	0.6
Anaemia	7	1.05
SLE	0	0.0
APS	1	0.15
Hypothyroidism	27	4.06
Low maternal weight	34	5.1
Unknown	270	40.66
None	286	43.0

SLE = Systemic Lupus Erythematous; APS = antiphospholipid syndrome.

2.8 and 73.5 ± 3.3 mm, and 257.8 ± 20.9 and 3,115 ± 663.7g, respectively. The mean measurements of each biometric parameter from our study demonstrated significant differences compared to the 50th percentile measurements from both the INTERGROWTH-21st project (p<0.05) and Lagos (p<0.05) data across various gestational ages. Specifically, the length of the femur was longer in most cases when compared with the INTERGROWTH-21st data (weeks 17-25 and 27-37). The biparietal diameter and head circumference were parameters that showed the most differences when compared with Lagos data (weeks 20-24, 27-36 and weeks 20-24, 27-37 respectively).Appendix 2 to 6 shows the differences between the media EFW and each of ultrasound parameters of pregnant women from our population and the 50th centile of the INTERGROWTH-21st project and the 50th centile of Lagos from 16 to 40 week.

Discussion

This study indicates that, although the curves of the biometric parameters and the EFW of fetuses in our local population have a similar distribution to those in the INTERGROWTH-21st project and the Latin American curves of Lagos, the biometric parameter data from our population show statistically significant differences compared to these reference charts.

It is known that the alterations of fetal weight are one of the variables that most contribute to neonatal morbidity, therefore, the identification of these alterations by a closer follow-up of fetal growth is relevant to prevent an adverse perinatal outcome.[2]

Figure 1

Box and whisker plots of 1,133 estimated fetal weights measured by ultrasound from 16 to week 40. Bogotá, Colombia. 2015 to 2018.

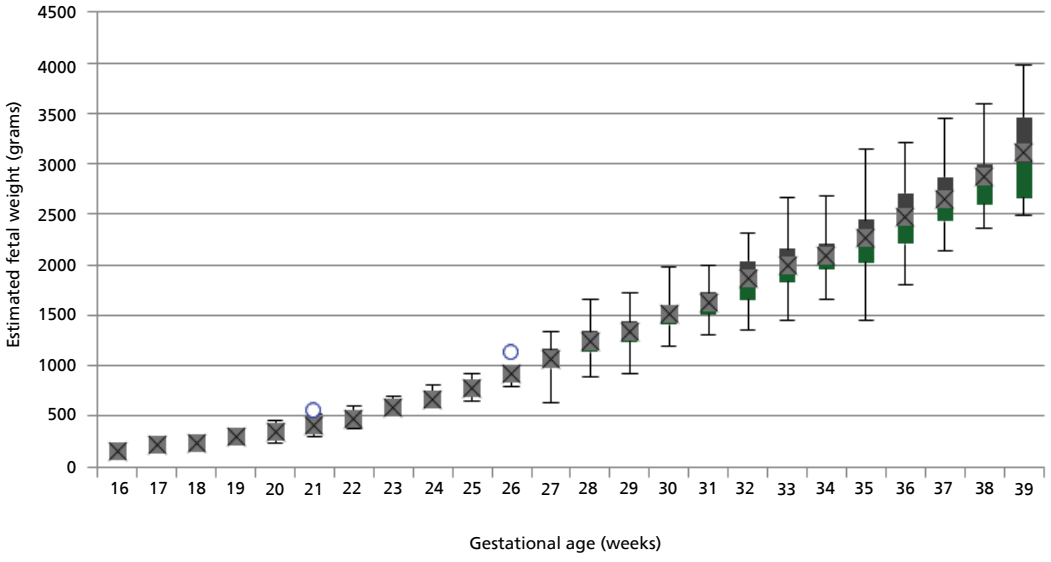


Figure 2

Box and whisker plots that shows the distribution of 1,133 Biparietal Diameters (a), Head Circumference (b),Abdominal Circumference (c), and Femur Length (d), measured by ultrasound from 16 to week 40. Bogotá, Colombia, 2015 to 2018.

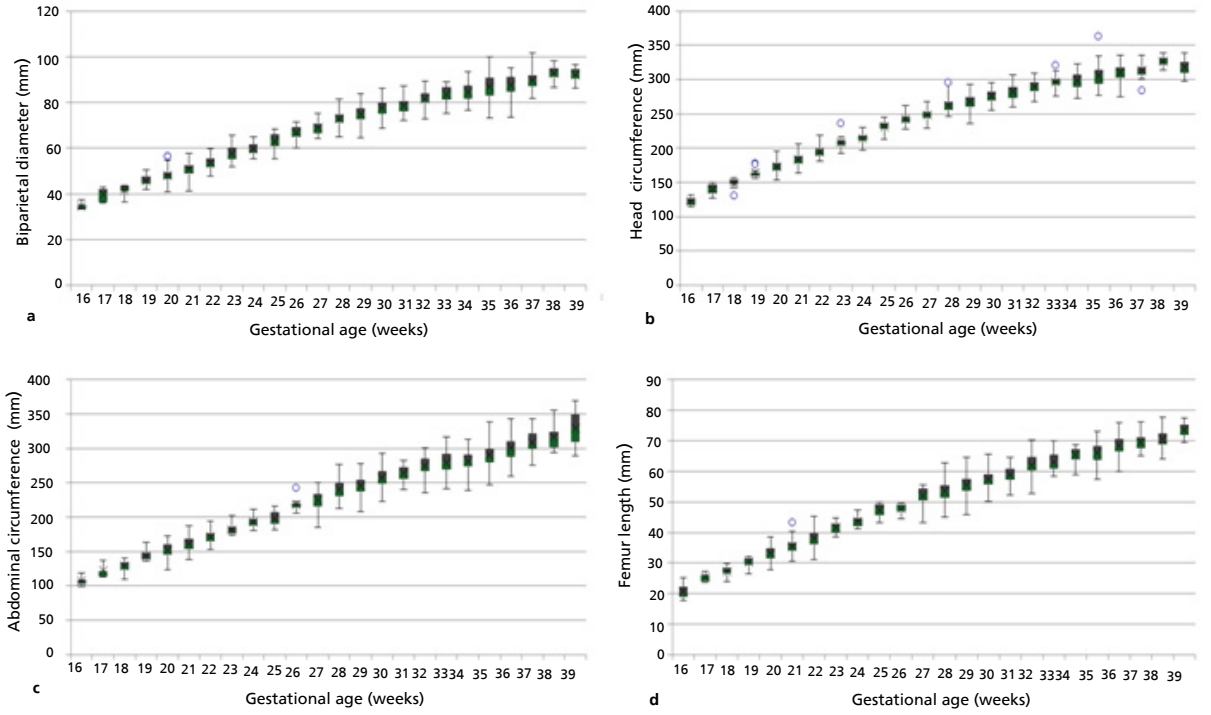
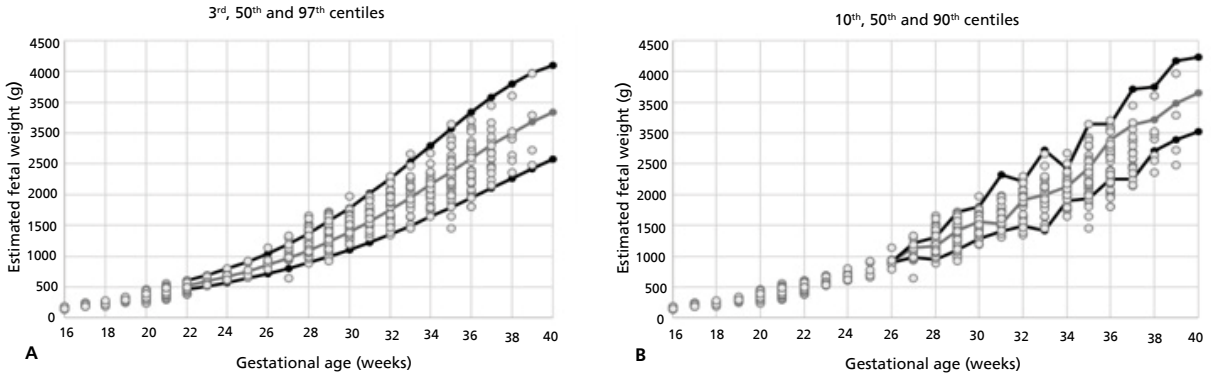


Figure 3

Distribution of estimated fetal weight values in pregnant women from Bogotá between 16 to 40 weeks in relatedto the 3rd, 50th and 97th centiles of INTERGROWTH-21st project and compared to the 10th, 50th and 90th centiles of Lagos. Bogotá, Colombia, 2015 to 2018.



A) Black lines and dots represent centiles 3rd and 97th and gray lines and dots represent the centile 50th;
B) Black lines and dots represent centiles 10th and 90th and gray lines and dots represent the centile 50th.

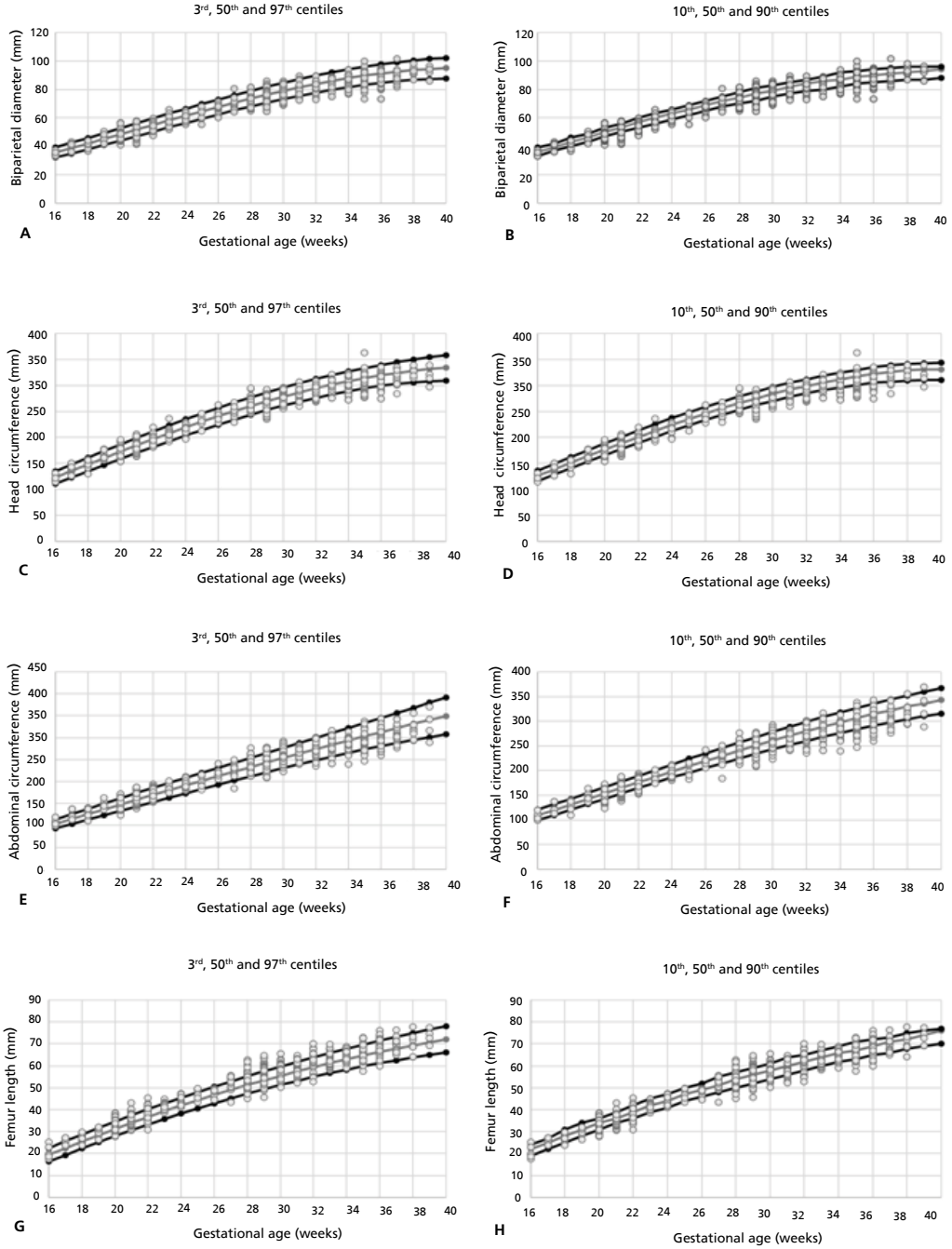
However, to determine a normal growth standard through the most accurate chart for each population is not easy.

There are multiple formulas to calculate the estimated fetal weight, as Hadlock's formulas,[7] which are used in North America; like those Campbell and Thoms,[17] Shepard*et al.*[20] and Warsof *et al.*[21] in Great Britain; Merz's[22] in Germany and in Latin America Lagos *et al.*[6] and Vaccaro's[23] formulas are the most applied. Likewise, there are also multiple population-based charts to assess fetal growth among the different ethnic groups.[6,24]In Latin America, one of the largest studies was published by Araujo *et al.*[25] on the Brazilian population. However, Hadlock is one of the most used formulas in the Western Hemisphere, with a margin of error of around 8.9% compared with the neonatal weight.[8]

INTERGROWTH-21st project tried to obtain international standards charts for fetal measurement, while Lagos' fetal biometrics marks standards to Chilean population. In our study, all the biometrics parameters showed a progressive increase pattern until week 35 and most of the data were between the 3rd and 97th centiles of INTERGROWTH-21st project

Figure 4

Distribution of Biparietal Diameter (A), Head Circumference (C), Abdominal Circumference (E), and Femur Length (G) values in pregnant women from our local population between 16 to 40 weeks compared to the 3rd, 50th and 97th centiles of INTERGROWTH-21st project and compared to the 10th, 50th and 90th centiles of Lagos. Bogotá, Colombia, from February 2015 to November 2018.



Black lines and dots represent centiles 10th and 90th and gray lines and dots represent the centile 50th.

and between the 10th and 90th of Lagos. In these two studies, there was a slight decrease of the fetal biometric parameters at the end of the pregnancy, which results in a discrete flattening of the curve, like our study; except for the abdominal circumference whose curve continues to rise. Furthermore, the media abdominal circumference showed statistically significant differences with 50th centile of the INTERGROWTH-21st at advanced gestational ages and it is important to consider that these differences could affect the calculation of gestational age and the EFW, depending on the reference's charts used.[26]

In the same way, it can be observed that there were significant differences between the media of FL of fetuses from our population compared with INTERGROWTH-21st project, but not with the Lagos study, being longer the femur of our fetuses. Hammami *et al.*,[27]showed that

the models providing the most accurate prediction of birth weight are those that include the measurements of BPD, HC, AC and FL and the most accurate model was provided by the formula of Hadlock, published in 1985. The differences of FL measurement could be relevant to the calculation of EFW in our study, although, there are some authors that considerer that FL is not determinant for the calculation of EFW, others believe that it improves its accuracy.[28,29]

Furthermore, it is important to consider the customized charts. In this sense, Odibo *et al*.,[30] in 2018, performed a study comparing the curves of the INTERGROWTH-21st project with a customized charts for predicting fetuses at risk of developing low birth weight and adverse perinatal outcomes, and they found that both had low sensitivity for predicting low birth weight (24.5 *vs* 38.8% respectively) and poor performance at predicting short-term adverse perinatal outcomes.[30]This premise could support the importance of local population charts over the customized and international growth curves.

Although the curves of the biometric parameters and the EFW of the fetuses in our population showed a similar distribution to those in the INTERGROWTH-21st project and the Latin American curves of Lagos, the biometric parameters datafrom our population show statistically significant differences compared to these reference charts. It is important to consider these differences when evaluating fetal growth in each population.

The main contribution of this study is to define that customized or local charts are more useful for monitoringfetal growth and detecting abnormalities early. The authors consider that one of the limitations of this study is the small amount of data for some weeks, especially towards the end of pregnancy, and the limited sample of pregnant women from Bogotá, which reduces the study's power.

With the results of this study, evaluation of fetal growth with international charts may represent a clinical issue as there was statistically significant differences of biometric parameters such as AC and FL when those were evaluated. We considered that more studies are needed to determine optimal reference charts for local populations and include studies that evaluate the correlation of the estimated fetal weight calculated by ultrasonography with the birth weight.

Authors' contribution

Vallejo Bastidas GM: conception and design of the work, analysis and interpretation of the results, writing and critical review of the manuscript. Calvo MU and Romero XC: conception and design of the work, collection/obtaining of data, analysis and interpretation of the results, and writing and critical review of the manuscript. De la Hoz-Valle J: processing, analysis and interpretation of the results, methodological and statistical advice, and critical review of the manuscript. The authors approved the final version of the article and declare that there are no conflicts of interest.

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Appendix 1

Characterization of fetal biometric measurements per weekin Bogotá, Colombia, from February 2015 to November 2018.

GA	Ultrasound exams	BPD		HC		AC		FL		EFW	
Weeks	n (%)	BPD Mean	BPD SD	HC Mean	HC SD	AC Mean	AC SD	FL Mean	FL SD	EFW Mean	EFW SD
16	6 (0,52)	34,7	1,5	122,1	6,6	107,2	6,8	20,6	2,8	157,8	20,9
17	9 (0,79)	39,8	2,8	139,7	8,9	122,1	9,1	25,4	1,2	211,1	25,3
18	12 (1,05)	41,6	2,3	148,3	7,2	129,1	8,3	27,3	1,8	237,1	23,6
19	11 (0,97)	45,8	2,7	162,2	9,2	144,4	8,3	30,2	1,6	296,6	26,4
20	82 (7,23)	48,0	2,8	173,2	8,2	152,5	10,5	33,2	2,4	353,3	45,8
21	215 (18,9)	50,7	2,7	183.0	9,2	161,4	9,4	35,3	2,0	406,4	43,8
22	71 (6,26)	53,7	2,5	193,4	13,6	171,8	8,6	37,9	2,5	478,8	51,7
23	18 (1.58)	57,7	3,4	208,5	10,1	182,2	7,7	41,5	1,6	578,9	49,7
24	19 (1,67)	59,6	2,4	214,5	7,6	193,6	8,4	43,6	1,8	664,7	54,0
25	6 (0,52)	63.0	4,7	231.0	11.0	198,2	13,1	47,2	2,5	773,5	112,8
26	10 (0,88)	66,7	3,7	242,4	9,2	218,7	9,5	47,9	1,8	916,6	90,0
27	15 (1,32)	69,1	3,1	246.0	12,4	225,8	15,8	52	3,1	1062,7	168,2
28	92 (8,12)	72,9	3,3	238,5	16,3	240,3	13,1	53,5	3,1	1234,6	149,3
29	234 (20,65)	74,9	3,3	267,2	10,4	245,5	13,5	55,7	2,7	1343,2	155,4
30	79 (6,97)	77,4	3,5	275,2	9,8	257,4	13,1	57,4	2,7	1512,4	143,4
31	34 (3,00)	78,7	3,4	282,3	9,9	263,7	11,3	58,8	3,0	1628,9	174,4
32	32 (2,82)	82,3	2,8	290,2	10,4	275,6	16,3	61,9	4,0	1862,1	261,3
33	27 (2,38)	83,4	3,9	296,6	10,8	279,5	19,3	63,1	3,1	1990,7	295,8
34	38 (3.35)	84,4	4,1	298,5	13,5	281,7	13,6	65,3	2,3	2083,9	218,4
35	45 (3,97)	86,7	5,1	305,5	16.2	290,4	18,7	66.1	3,2	2257,2	333,7
36	47 (4,14)	87,6	4,7	310.0	13,4	300,5	18,3	68,3	3,4	2476,3	352,3
37	20 (1,76)	89,5	4,4	313,9	12,6	309,2	18,2	69,6	2,8	2652	343,9
38	7 (0,61)	92,9	3,7	326,7	8,2	316,8	21,5	70,5	4,2	2866,4	403,5
39	4 (0,35)	92,2	4,4	318.0	17.0	329,3	34,6	73,5	3,3	3115	663,7

GA= gestational age; BPD= biparietal diameter; HC= head circumference; AC= abdominal circumference; FL= femur length; EFW= estimated fetal weight; SD= standard deviation.

Appendix 2

Estimated fetal weight in Bogotá, Colombia, from February 2015 to November 2018 compared with the 50th centile of INTERGROWTH-21st and Lagos.

Weeks	Mean EFW study	50th EFW INTERGROWTH-21st	Difference (grams)	*p*	50th EFW Lagos.	Difference (grams)	*p*
22	478,87	525,0	46,1	0,0000			
23	578,94	592,0	13,06	0,2121*			
24	664,79	669,0	4,21	0,3979*			
25	773,50	756,0	-17,50	0,7198			
26	916,60	856,0	-60,60	0,0623	912	-4,60	0,8753
27	1062,73	969,0	-93,73	0,0488	1135	72,27	0,1183
28	1234,61	1097,0	-137,61	0,0000	1169	-65,61	0,0327
29	1343,26	1239,0	-104,26	0,0000	1414	70,74	0,0000
30	1512,43	1396,0	-116,43	0,0000	1564	51,57	0,0020
31	1628,91	1568,0	-60,91	0,0498	1529	-99,91	0,0021
32	1862,19	1755,0	-107,19	0,0271	1914	51,81	0,2708
33	1990,70	1954,0	-36,70	0,5248	2002	11,30	0,8443
34	2083,95	2162,0	78,05	0,0340	2131	47,05	0,1924
35	2257,20	2378,0	120,80	0,0194	2430	172,80	0,0012
36	2476,34	2594,0	117,66	0,0267	2897	420,66	0,0000
37	2652,05	2806,0	153,95	0,0598	3131	478,95	0,0000
38	2866,43	3006,0	139,57	0,3955	3222	355,57	0,0586
39	3115,00	3186,0	71,00	0,8443	3487	372,00	0,3439
40	NA	3338	NA	NA	3652	NA	NA

Differences between the mean of estimated fetal weight from our population and the 50th centile of the INTERGROWTH-21st data from 22 to 39 week (Stirnemann *et al.*,[8] Ultrasound Obstet Gynecol. 2017) and the 50th centile of Lagos *et al.*, from 26 to 39 week (Lagos *et al.*[9] Rev Hosp Mat Inf Ramón Sardá. 2002). *Wilcoxon signed-rank test. EFW= estimated fetal weight; NA= Not available.

Appendix 3

Biparietal diameter in Bogotá, Colombia, from February 2015 to November 2018 compared with the 50th centile of INTERGROWTH-21st and Lagos.

Weeks	Mean BPD study	50th BPD INTERGROWTH-21st	Difference (mm)	*p*	50th BPD Lagos *et al.*	Difference (mm)	*p*
16	34,73	35,7	0,97	0,1853	36	1,27	0,1004
17	40,70	38,8	-1,90	0,4258*	39	-1,70	0,4753*
18	41,90	42,0	0,10	0,9697*	43	1,10	0,0653*
19	45,82	45,2	-0,62	0,4690	46	0,18	0,8293
20	48,01	48,4	0,39	0,2134	50	1,99	0,0000
21	50,75	51,7	0,95	0,0000	53	2,25	0,0000
22	53,71	55,0	1,29	0,0001	57	3,29	0,0000
23	57,72	58,2	0,5	0,5635	60	2,28	0,0127
24	59,65	61,4	1,75	0,0066	63	3,35	0,0000
25	63,03	64,5	1,47	0,4807	66	2,97	0,1841
26	66,79	67,6	0,81	0,5078	69	2,21	0,0925
27	69,17	70,6	1,43	0,1026	72	2,83	0,0020
28	72,98	73,5	0,52	0,1368	74	1,02	0,0008
29	74,91	76,3	1,39	0,0000	77	2,09	0,0000
30	77,46	78,9	1,44	0,0002	79	1,54	0,0001
31	78,70	81,4	2,70	0,0001	82	3,30	0,0000
32	81,54	83,8	2,26	0,0010	84	2,46	0,0004
33	83,47	85,9	2,43	0,0035	86	2,53	0,0025
34	84,44	87,9	3,46	0,0000	87	2,56	0,0005
35	86,74	89,7	2,96	0,0004	89	2,26	0,0052
36	87,40	91,2	3,80	0,0000*	90	2,60	0,0025*
37	89,52	92,5	2,98	0,0074	91	1,48	0,1527
38	92,90	93,6	0,70	0,6373	92	-0,90	0,5469
39	92,23	94,4	2,18	0,3984	93	0,78	0,7495
40	NA	94,9	NA	NA	94	NA	NA

Differences between the mean of Biparietal Diameter of pregnant women from our population and the 50th centile of the INTERGROWTH-21st project from 16 to 40 week (Stirnemann *et al.*,[8] Ultrasound Obstet Gynecol. 2017) and the 50th centile of Lagos *et al.*, from 16 to 40 week (Lagos *et al.*[9] Rev Hosp Mat Inf Ramón Sardá. 2002) *Wilcoxon signed-rank test. BPD= biparietal diameter; NA= Not available.

Appendix 4

Head circumference in Bogotá, Colombia, from February 2015 to November 2018 compared with the 50th centile of INTERGROWTH-21st and Lagos.

Weeks	Mean HC study	50th HC INTERGROWTH-21st	Difference (mm)	*p*	50th HC Lagos *et al.*	Difference (mm)	*p*
16	122,17	122,9	0,73	0,7966	126	3,8333	0,2146
17	139,77	135,4	-4,37	0,1824	138	-1,77	0,5710
18	148,37	147,9	-0,47	0,8268	151	2,63	0,2323
19	161,80	160,3	-1,50	0,0828*	164	2,20	0,6247*
20	173,20	172,5	-0,70	0,4395	176	2,80	0,0028
21	183,43	184,5	1,07	0,0501	188	4,57	0,0000
22	195,10	196,3	1,20	0,1747	200	4,90	0,0000
23	208,40	207,8	-0,60	0,7604*	212	3,60	0,0331*
24	214,55	219,1	*4,55*	0,0187	224	9,45	0,0000
25	231,05	230,0	-1,05	0,8255	235	3,95	0,4221
26	242,48	240,5	-1,98	0,5134	246	3,52	0,2573
27	248,31	250,7	2,39	0,1597	256	7,69	0,0054
28	262,25	260,4	-1,85	0,0537*	266	3,75	0,0003*
29	267,47	269,6	2,13	0,0014	275	7,53	0,0000
30	275,73	278,4	2,67	0,0106	284	8,27	0,0000
31	282,27	286,6	4,33	0,0177	292	9,73	0,0000
32	290,24	294,4	4,16	0,0391	299	8,76	0,0000
33	296,65	301,5	4,85	0,0278	306	9,35	0,0001
34	298,58	308,1	9,52	0,0001	312	13,42	0,0000
35	305,58	314,1	8,52	0,0010	318	12,42	0,0000
36	313,20	319,4	6,20	0,0000*	322	8,80	0,0000*
37	314,00	324,1	10,11	0,0020	326	12,01	0,0004
38	326,79	328,1	1,31	0,6867	329	2,21	0,5023
39	318,00	331,4	13,4	NA	331	13,00	NA
40	NA	333,9	NA	NA	331	NA	NA

Differences between the mean of head circumference of pregnant women from our population and the 50th centile of the INTERGROWTH-21st project from 16 to 40 week (Stirnemann *et al.*,[8] Ultrasound Obstet Gynecol. 2017) and the 50th centile of Lagos from 16 to 40 week (Lagos *et al.*[9] Rev Hosp Mat Inf Ramón Sardá. 2002) *Wilcoxon signed-rank test. HC= head circumference; NA= Not available.

Appendix 5

Abdominal circumference in Bogotá, Colombia, from February 2015 to November 2018 compared with the 50th centile of INTERGROWTH-21st and Lagos.

Weeks	Mean AC study	50th AC INTERGROWTH-21st	Difference (mm)	*p*	50th AC Lagos.	Difference (mm)	*p*
16	107,25	103,2	-4,05	0,2092	109	1,75	0,5608
17	120,80	114,4	-6,40	0,0547*	120	-0,80	0,7218*
18	129,11	125,6	-3,51	0,1715	131	1,89	0,4469
19	140,10	136,7	-3,40	0,0051*	142	1,90	0,6248*
20	152,55	147,7	-4,85	0,0001	154	1,45	0,2151
21	161,44	158,7	-2,74	0,0000	165	3,56	0,0000
22	171,83	169,6	-2,23	0,0141	176	4,17	0,0001
23	179,30	180,4	1,1	0,7987*	187	7,70	0,0208*
24	193,68	191,2	-2,48	0,2140	198	4,32	0,0381
25	198,20	201,8	3,60	0,5326	209	10,80	0,1007
26	218,71	212,4	-6,31	0,0656	220	1,29	0,6784
27	225,23	222,9	-2,33	0,5775	230	4,77	0,2616
28	240,32	233,3	-7,02	0,0000	241	0,68	0,6216
29	245,56	243,6	-1,96	0,0280	251	5,44	0,0000
30	257,48	253,8	-3,68	0,0152	261	3,52	0,0199
31	263,70	263,9	0,20	0,9198	271	7,30	0,0007
32	274,32	273,9	-0,42	0,8856	280	5,68	0,0581
33	279,59	283,8	4,21	0,2687	289	9,41	0,0180
34	281,79	293,6	11,81	0,0000	298	16,21	0,0000
35	290,42	303,3	12,88	0,0000	307	16,58	0,0003
36	300,58	312,8	12,22	0,0000	315	14,42	0,0000
37	309,30	322,3	13,00	0,0049	322	12,70	0,0057
38	316,89	331,6	14,71	0,1202	330	13,11	0,1578
39	329,38	340,8	11,43	0,5566	336	6,63	0,7276
40	NA	350	NA	NA	343	NA	NA

Differences between the mean of abdominal circumference of pregnant women from our population and the 50th centile of the INTERGROWTH21 project from 16 to 40 week (Stirnemann *et al.*,[8] Ultrasound Obstet Gynecol. 2017) and the 50th centile of Lagos, from 16 to 40 week (Lagos *et al.*[9] Rev Hosp Mat Inf Ramón Sardá. 2002)
*Wilcoxon signed-rank test. AC= abdominal circumference; NA= Not available.

Appendix 6

Femur length in Bogotá, Colombia, from February 2015 to November 2018 compared with the 50th centile of INTERGROWTH-21st and Lagos.

Weeks	Mean FL study	50th FL INTERGROWTH-21st	Difference (mm)	*p*	50th FL Lagos	Difference (mm)	*p*
16	20,68	19,5	-1,18	0,3614	22	1,32	0,3147
17	25,49	22,5	-2,99	0,0001	25	-0,49	0,2901
18	27,30	25,5	-1,80	0,0065	28	0,70	0,2191
19	30,28	28,5	-1,78	0,0060	31	0,72	0,1914
20	33,26	31,3	-1,96	0,0000	34	0,74	0,0082
21	35,38	34,1	-1,28	0,0000	36	0,62	0,0000
22	37,95	36,7	-1,25	0,0001	39	1,05	0,0006
23	41,59	39,4	-2,19	0,0000	42	0,41	0,3108
24	43,40	41,9	-1,50	0,0015*	44	0,60	0,3046*
25	47,27	44,4	-2,87	0,0424	47	-0,27	0,8111
26	48,80	46,7	-2,10	0,0753*	49	0,20	0,1934*
27	52,70	49,0	-3,70	0,0054*	51	-1,70	0,0830*
28	52,70	51,3	-1,40	0,0000	54	1,30	0,1628
29	55,70	53,4	-2,30	0,0000	56	0,30	0,1024
30	57,41	55,5	-1,91	0,0000	58	0,59	0,0547
31	58,84	57,5	-1,34	0,0155	60	1,16	0,0337
32	61,90	59,4	-2,50	0,0016	62	0,10	0,8943
33	63,18	61,3	-1,88	0,0049	64	0,82	0,1900
34	66,05	63,1	-2,95	0,0000*	66	-0,05	0,2739*
35	66,16	64,8	-1,36	0,0084	67	0,84	0,0925
36	68,40	66,4	-2,00	0,0002	69	0,60	0,2367
37	69,60	67,9	-1,70	0,0138	71	1,40	0,0378
38	70,54	69,4	-1,14	0,5045	72	1,46	0,4004
39	73,55	70,8	-2,75	0,1994	74	0,45	0,8057
40	NA	72	NA	NA	76	NA	NA

Differences between the mean of femur length of pregnant women from our population and the 50th centile of the INTERGROWTH 21 project from 16 to 40 week (Stirnemann *et al.*,[8] Ultrasound Obstet Gynecol. 2017) and the 50th centile of Lagos, from 16 to 40 week (Lagos *et al.*[9] Rev Hosp Mat Inf Ramón Sardá. 2002)* Wilcoxon signed-rank test. FL= femur length; NA= Not available.