OB/GYN SECTION

Fetal ultrasound biometry: Normative charts for a Puerto Rican population

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Purpose: **To evaluate fetal growth parameters throughout gestation in Puerto Rican women and compare them to other mixed U.S. populations.**

Methods: **Cross-sectional study of 548 patients who met inclusion criteria of Puerto Rican ancestry, no history of drug, alcohol or tobacco use, no identifiable fetal anomalies, normal amniotic fluid and certainty of last menstrual period. Standard sonographic biometric data (biparietal diameter, occipito-frontal diameter, head circumference, abdominal circumference, femur length and estimated fetal weight) was obtained for each gestational age between 13 and 38 weeks and the 10th, 50th, and 90th percentile determined for each one. Results were compared to those of other mixed U.S. populations.**

Results: **Biometric data on fetal growth throughout gestation among Puerto Ricans is presented. Comparison with other mixed populations did not show any significant differences in fetal biometric measurements throughout pregnancy.**

Conclusions: **Different to other ethnic groups, Puerto Ricans show similar fetal growth patterns as those reported from mixed U.S. populations. This information validates the use of these reference values in the evaluation of fetuses in Puerto Rico.**

Key words: Fetal growth, Biometry, Puerto Rican population, Sonography.

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.

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In Puerto Rico, there are no published normative sonographic standards. We have always relied on data derived from mixed U.S. populations. This may or may not be applicable to our population. The purpose of this study is to provide reference fetal biometric data for a group of Puerto Rican pregnant women.

Methods

This cross sectional study (each patient's data was used only once) was conducted at the Puerto Rico University Hospital, Antenatal Evaluation Unit, a tertiary care institution. A total of 548 patients between 13 and 38 weeks of gestation referred for routine sonographic evaluation were enrolled after they met inclusion criteria. The data obtained was anonymous as part of a routine prenatal sonographic evaluation based on the American Institute of Ultrasound in Medicine (AIUM) recommendations for antepartum obstetric sonographic evaluation (3).

Inclusion criteria consisted of: a) Puerto Rican ancestry (both the father and mother), b) maternal certainty of her last menstrual period, c) absence of any identifiable fetal anomaly on ultrasound, d) presence of normal amniotic fluid levels at the time of evaluation, e) no history of maternal drug, alcohol or tobacco use, and f) absence of any maternal illness. Patients who met all inclusion criteria were performed standard sonographic measurements as

recommended by the AIUM (3). The data consisted of measurement of the BPD, OFD, HC, AC, FL and estimation of fetal weight (EFW) using Hadlock's formula (4). Each measurement was obtained 3 times by a certified experienced sonographist and the results were averaged. Collected data was grouped by gestational age. For each parameter measured, the 10th, 50th, and 90th percentile were determined for each gestational age using Microsoft Excel data functions and tabulated. The 50th percentiles for each parameter measured were then compared to published data for mixed populations by Hadlock (5), Merz (6), Jeanty and Romero (7).

Results

The results for the measurements of the BPD, OFD, HC, AC, FL and EFW as a function of gestational age are presented in tables 1 through 6.

Comparison with commonly used data for the BPD by Hadlock (5), the HC and AC by Merz (6) and the FL by Jeanty and Romero (7), shows no significant differences between our population and those reported by these authors.

Table 1. Distribution of biparietal diameters throughout pregnancy among Puerto Ricans (N=548)

BPD (mm)				BPD (mm)			
GA	P10	P50	P90	GA	P10	P50	P90
13.5	22	25	27	26.0	58	66	69
14.0	23	27	29	26.5	61	67	70
14.5	25	28	31	27.0	63	68	71
15.0	30	32	33	27.5	65	70	72
15.5	30	33	36	28.0	67	70	75
16.0	32	35	37	28.5	68	72	75
16.5	34	35	38	29.0	70	73	75
17.0	36	39	42	29.5	71	75	79
17.5	37	39	43	30.0	71	76	80
18.0	37	41	46	30.5	71	77	81
18.5	39	42	45	31.0	74	78	87
19.0	41	45	47	31.5	77	79	85
19.5	42	45	48	32.0	77	81	87
20.0	42	46	49	32.5	77	81	88
20.5	46	48	51	33.0	77	83	89
21.0	46	50	52	33.5	77	84	89
21.5	45	51	54	34.0	83	86	90
22.0	47	53	56	34.5	84	87	90
22.5	50	55	57	35.0	82	86	89
23.0	54	56	59	35.5	82	87	94
23.5	55	57	61	36.0	84	88	95
24.0	56	60	63	36.5	85	88	91
24.5	58	62	66	37.0	85	89	91
25.0	58	63	66	37.5	86	89	92
25.5	57	65	66	38.0	86	91	93

BPD=Biparietal diameter in millimeters (mm), GA=gestational age in weeks (wks), p=percentile.

Discussion

In order for a fetal sonographic evaluation to be reliable, the reference standards used should also be reliable and applicable to the population studied. In Puerto Rico, no normative data was previously available on fetal growth parameters nor was any previous comparison performed to validate if the use of data derived from other populations could be done with reliability. The data presented in this article for standard sonographic measurements in a Puerto Rican population shows no significant differences from other published reports derived from mixed populations (5,6,7).

Puerto Ricans are a heterogeneous group that derive their ancestry mainly from Europeans, Africans Negroes, and Caribbean Indians. There are marked differences in the genetic contribution from each of these groups, for which Puerto Ricans can be considered a mixed population. This fact may explain the differences in fetal growth parameters seen among various ethnic groups, but which are not evident in our population. Our results support the use of fetal sonographic biometric standards derived from mixed U.S. populations in the evaluation of fetal growth in Puerto Rico.

Table 2. Distribution of occipito-frontal diameters throughout pregnancy among Puerto Ricans (N=548)

OFD (mm)				OFD (mm)			
GA	**P10**	**P50**	**P90**	**GA**	**P10**	**P50**	**P90**
13.5	28	32	34	26.0	79	87	93
14.0	28	33	36	26.5	81	87	93
14.5	32	35	40	27.0	86	91	93
15.0	36	40	41	27.5	89	92	96
15.5	37	41	45	28.0	89	92	97
16.0	39	44	48	28.5	90	94	100
16.5	42	45	49	29.0	92	96	101
17.0	45	49	53	29.5	94	99	106
17.5	48	51	57	30.0	96	102	106
18.0	50	54	57	30.5	97	102	106
18.5	52	55	59	31.0	97	105	112
19.0	53	56	62	31.5	100	107	113
19.5	53	57	64	32.0	99	105	112
20.0	56	61	65	32.5	100	105	113
20.5	59	62	69	33.0	101	106	117
21.0	61	65	71	33.5	100	107	116
21.5	60	66	72	34.0	101	110	113
22.0	60	69	75	34.5	102	111	120
22.5	65	73	76	35.0	103	111	123
23.0	70	73	76	35.5	102	112	121
23.5	70	74	80	36.0	110	116	123
24.0	75	78	82	36.5	112	117	124
24.5	77	80	85	37.0	108	116	122
25.0	80	84	89	37.5	108	115	117
25.5	80	86	91	38.0	113	117	124

OFD = occipito-frontal diameter in millimeters (mm), GA=gestational age in weeks (wks), p = percentile.

Table 3. Distribution of head circumferences throughout pregnancy among Puerto Ricans (N=548)

HC (mm)				HC (mm)			
GA	**P10**	**P50**	**P90**	**GA**	**P10**	**P50**	**P90**
13.5	80	88	96	26.0	219	241	251
14.0	82	96	102	26.5	231	243	254
14.5	89	99	110	27.0	232	248	257
15.0	104	111	117	27.5	242	253	262
15.5	107	115	127	28.0	246	256	269
16.0	111	124	131	28.5	247	264	272
16.5	119	126	137	29.0	258	267	274
17.0	127	138	147	29.5	261	274	287
17.5	134	140	161	30.0	262	277	290
18.0	137	148	162	30.5	261	278	295
18.5	144	151	163	31.0	270	292	303
19.0	150	159	171	31.5	278	294	311
19.5	150	163	173	32.0	277	294	311
20.0	155	170	176	32.5	279	293	315
20.5	165	173	188	33.0	280	295	319
21.0	168	179	191	33.5	283	307	316
21.5	168	184	198	34.0	292	306	316
22.0	171	193	203	34.5	295	309	329
22.5	183	200	209	35.0	294	309	329
23.0	194	204	209	35.5	289	312	334
23.5	193	207	221	36.0	310	320	335
24.0	208	219	226	36.5	317	322	334
24.5	212	223	237	37.0	306	319	333
25.0	217	231	240	37.5	307	320	325
25.5	219	237	246	38.0	317	325	339

HC = head circumference in millimeters (mm), GA=gestational age in weeks (wks), p = percentile.

Table 4. Distribution of abdominal circumferences throughout pregnancy among Puerto Ricans (N=548)

AC (mm)				AC (mm)			
GA	**P10**	**P50**	**P90**	**GA**	**P10**	**P50**	**P90**
13.5	62	79	86	26.0	172	211	223
14.0	62	79	84	26.5	201	221	235
14.5	73	81	88	27.0	207	225	232
15.0	81	93	105	27.5	205	226	246
15.5	84	102	108	28.0	220	235	251
16.0	96	104	115	28.5	226	243	265
16.5	97	107	115	29.0	237	253	265
17.0	105	115	129	29.5	236	257	273
17.5	112	121	135	30.0	238	258	275
18.0	114	126	135	30.5	237	262	276
18.5	118	132	141	31.0	247	269	290
19.0	124	138	155	31.5	254	275	293
19.5	124	140	156	32.0	243	274	286
20.0	129	149	161	32.5	246	277	304
20.5	143	152	170	33.0	253	284	318
21.0	143	158	171	33.5	260	289	312
21.5	148	164	182	34.0	282	300	315
22.0	151	174	184	34.5	282	300	312
22.5	164	178	190	35.0	280	300	312
23.0	167	179	190	35.5	279	306	334
23.5	167	184	203	36.0	294	318	335
24.0	186	198	210	36.5	299	319	334
24.5	182	198	217	37.0	298	316	331
25.0	184	203	226	37.5	304	315	333
25.5	185	207	223	38.0	303	329	348

AC = abdominal circumference in millimeters (mm), GA=gestational age in weeks (wks), p = percentile.

Table 5. Distribution of femur lengths throughout pregnancy among Puerto Ricans (N=548)

FL (mm)				FL (mm)			
GA	**P10**	**P50**	**P90**	**GA**	**P10**	**P50**	**P90**
13.5	10	10	12	26.0	45	48	51
14.0	10	13	15	26.5	47	49	53
14.5	12	14	16	27.0	48	50	53
15.0	15	17	19	27.5	50	52	55
15.5	16	18	20	28.0	49	53	55
16.0	18	20	23	28.5	49	54	58
16.5	19	21	23	29.0	52	55	58
17.0	20	23	25	29.5	53	56	60
17.5	22	24	28	30.0	53	58	60
18.0	24	27	29	30.5	54	59	61
18.5	24	27	30	31.0	57	61	64
19.0	27	30	32	31.5	57	61	67
19.5	27	30	33	32.0	57	61	66
20.0	27	33	35	32.5	57	61	67
20.5	31	33	36	33.0	58	63	67
21.0	31	34	39	33.5	60	64	66
21.5	31	35	40	34.0	62	66	68
22.0	32	38	41	34.5	64	66	69
22.5	34	39	43	35.0	64	66	69
23.0	37	40	43	35.5	63	68	73
23.5	36	42	45	36.0	66	70	73
24.0	42	44	46	36.5	66	69	72
24.5	43	44	49	37.0	67	69	73
25.0	43	47	51	37.5	68	71	72
25.5	45	48	50	38.0	71	72	73

FL = femur length in millimeters (mm), GA=gestational age in weeks (wks), p = percentile.

Table 6. Distribution of estimated fetal weights throughout pregnancy among Puerto Ricans (N=548)

EFW (gm)				EFW (gm)			
GA	**P10**	**P50**	**P90**	**GA**	**P10**	**P50**	**P90**
13.5	87	102	116	26.0	632	860	989
14.0	87	111	122	26.5	778	967	1093
14.5	106	120	129	27.0	891	994	1100
15.0	125	140	172	27.5	875	1076	1214
15.5	130	154	177	28.0	981	1181	1295
16.0	150	170	198	28.5	977	1250	1512
16.5	158	185	206	29.0	1114	1319	1518
17.0	182	209	250	29.5	1201	1428	1655
17.5	198	228	281	30.0	1213	1512	1699
18.0	211	251	292	30.5	1229	1571	1776
18.5	231	262	313	31.0	1370	1716	2063
19.0	250	308	376	31.5	1522	1787	2244
19.5	258	322	391	32.0	1439	1765	2090
20.0	261	367	409	32.5	1407	1810	2194
20.5	340	378	447	33.0	1408	1936	2473
21.0	326	411	506	33.5	1657	2090	2387
21.5	321	438	559	34.0	1906	2304	2559
22.0	360	507	567	34.5	1987	2319	2592
22.5	395	539	613	35.0	1966	2250	2592
23.0	454	563	635	35.5	1906	2418	3103
23.5	450	574	720	36.0	2208	2731	3255
24.0	613	672	810	36.5	2370	2761	3179
24.5	621	718	971	37.0	2295	2733	2973
25.0	627	797	1039	37.5	2348	2757	3023
25.5	636	825	947	38.0	2529	2956	3377

EFW = Estimated Fetal weight in grams (gm), GA=gestational age in weeks (wks), p = percentile.

Resumen

Propósito: Evaluar los parámetros de crecimiento fetal a traves del embarazo en pacientes puertorriqueñas y compararlas con otras poblaciones mixtas en los Estados Unidos. ***Métodos:*** Estudio de 548 pacientes que cumplieron con los criterios de inclusión (puertorriqueñas, sin historial de uso de drogas, alcohol o tabaco, sin anomalías congénitas detectables por sonografía, líquido amniótico normal y certeza de su última regla). Se tomaron datos biométricos estandarizados (diámetro biparietal, diámetro occipito-frontal, circumferencia de cabeza, circumferencia de abdomen, largo de fémur y peso fetal estimado) entre las 13 y 38 semanas de gestación y la décima, cincuenta y noventa percentila fue calculada para cada semana. Los resultados fueron comparados con otras poblaciones mixtas en los Estados Unidos. ***Resultados:*** Los datos biométricos de crecimiento fetal a través del embarazo en puertorriqueñas se presentaron para los parámetros antes descritos. Al compararlos con otras poblaciones mixtas en los E.U., no se encuentran diferencias significativas en tamaño o crecimiento a lo largo del embarazo. ***Conclusiones:*** Los resultados muestran que, a diferencia de otros grupos étnicos, los puertorriqueños muestran patrones de crecimiento fetal similares a los de otras poblaciones mixtas en los E.U. La gran variación entre un puertorriqueño y otro causadas por las contribuciones de cúlturas europeas, africana y caribeña en nuestra isla explica este comportamiento.

Esta información valida el uso de estos valores de referencia en la evaluación de fetos en Puerto Rico.

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