Intrauterine and Fetal Growth Standards for Saudi Arabia and the Gulf Region

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نظرا لعدم وجود جداول معيارية محلية تبين مقاييس النمو فقد قمنا بحساب وزن وطول ومحيط راس المواليد الذكور والاناث من عمر ٢٤ الى ٤٢ اسبوعا حمليا ولمجموعة بلغ عددها ٩٠٢٨ مولودا مفردا حيا متوزعين في اربع مستشفيات في مدينة الرياض (اي بنسبة ٢٧٫٦٪ من اجمالى الولادات بالرياض).

وحسب علمنا فان مقاييس النمو التى توصلنا اليها هى اول مقاييس معيارية للنمو تعكس بصدق نمو المواليد السعوديين الاحياء وربما المواليد العرب ايضا.

لذلك نقترح استخدام هذه المقاييس المعيارية عوضا عن المقاييس (الغربية) المسترشد بها حاليا.

As there are no standard growth charts for Arabs, we have calculated birth weight, length and head circumference centile standards for boys and girls between 24 and 42 weeks gestation from 9028 (27.6% of total births in Riyadh) singleton Saudi live births in four different hospitals in Riyadh. To the best of our knowledge these are the first growth standards which are truly representative of the Saudi and perhaps Arab live borns and we recommend that they should be used in preference to the 'Western' standards used at present.

Growth charts that are commonly used for birth weight, length and head circumference centile differ from one another. They vary both in mean and spread of values at different gestational ages. The variation is mainly due to the methodology used in constructing them and in the population studied. Since growth standards are constructed from birth weights of infants born at different gestational ages all of them have a common problem, i.e. the difficulty of accurately assessing gestational age and the universality of the population under study. A further problem is the lack of data relating to very early gestational ages. These and other factors make it essential that each community should have its own standards based on its own population studies.

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We believe we are presenting for the first time intrauterine and fetal growth standards for Saudi babies which are based on a population study and may be applicable not only for Saudi babies but also for newborn babies in the whole Arab and Gulf region.

Materials and Methods

Birth weight, length and head circumference (occipito-frontal circumference) were recorded for all singleton live-born Saudi babies between June 1984 and 1986 in four major hospitals of Riyadh. The four hospitals used catered for a wide area of the city of Riyadh and were thus assessing a study population representative of the city. It was statistically pre-determined to study 9000 babies so as to represent more than 25% of annual births in the city of Riyadh.

In each hospital a research team was established. It was composed of a consultant paediatrician or obstetrician, nurse-anthropometrician and an interviewer. Prior to the start of the study, the nurse-anthropometricians received a training course in taking anthropometric measurements. They were specifically trained to use the following: Harpenden stadiometer, skin fold caliper, infant measuring table, infantometers and weighing scales. The interviewers were trained in the use of the questionnaire and the medical terminology used in it.

Table 1
Mean values of the Swedish and Saudi Arabian study of attended size at birth in relation to sex and gestational week

Sex	Week	Weight (kg) Swed	Saud	Diff	Mean value length (cm) Swed	Saud	Diff	Head circumference (cm) Swed	Saud	Diff
Boys	36	2.76	2.89	−0.14	48.27	48.33	−0.06	33.69	33.57	0.12
Boys	37	2.99	2.96	0.03	49.11	48.90	0.21	34.25	33.89	0.37
Boys	38	3.21	3.19	0.01	49.87	49.26	0.62	34.74	34.46	0.29
Boys	39	3.40	3.26	0.14	50.57	49.83	0.74	35.16	34.45	0.71
Boys	40	3.57	3.33	0.24	51.21	50.03	1.18	35.50	34.75	0.71
Boys	41	3.70	3.46	0.24	51.81	50.74	1.07	35.76	35.12	0.64
Boys	42	3.79	3.53	0.26	52.37	50.80	1.57	35.95	35.33	0.62
Girls	36	2.64	2.79	−0.14	47.64	47.75	−0.11	33.25	32.84	0.41
Girls	37	2.88	2.85	0.02	48.46	47.95	0.51	33.78	33.19	0.59
Girls	38	3.09	3.08	0.02	49.18	48.86	0.32	34.22	33.78	0.45
Girls	39	3.29	3.16	0.13	49.82	49.21	0.61	34.59	34.05	0.54
Girls	40	3.45	3.23	0.22	50.40	49.50	0.90	34.88	34.28	0.60
Girls	41	3.56	3.32	0.25	50.92	50.05	0.87	35.11	34.55	0.56
Girls	42	3.63	3.48	0.15	51.40	50.38	1.02	35.29	34.8402	0.45

Table 2
Description of the total material, independent of sex and gestational age

	n	Mean	SD
Birth weight (kg)	8212	3.26	0.465
Birth length (cm)	8212	49.71	2.234
Birth head circumference (cm)	8212	34.47	1.383
Gestational age (weeks)	8212	39.71	1.149
Age of mother (years)	8212	25.91	5.886
Weight of mother (kg)	8106	64.87	12.608
Height of mother (cm)	8106	153.94	6.109
Placental weight (gm)	8153	0.57	0.105
Hb of mother (g/dl)	8212	12.06	1.623

Table 3a
Socioeconomic demographical data

	Mean	Range
Mother age (years)	25.9	12–48
Father age (years)	34.1	18–82
Family income/month (Saudi Riyals*)	3168	500–4000
	%	
Literate		
Mother	52.8	
Father	85.6	
Illiterate		
Mother	47.2	
Father	14.2	
Consanguinity	54.2	
Home ownership		
Villa	57.1	
Flat	29.6	
Mud/Tent	13.3	
Size of household		
Average persons/room	1.2	
Average persons/house	7.4	

*3.75 Saudi Riyals = 1 US dollar.

Between May and June 1984, a pilot study of 160 mothers was carried out to check the validity of the questionnaire and the reliability of measurements made.

Table 3b
Obstetric history

Obstetric data	Mean	Range
Number of pregnancies	4.4	0–20
Previous miscarriage (%)	15.9	0–4
Previous stillbirth (%)	2.9	0–8
Number of mothers who attended antenatal clinic (%)	19.4	0–44.6
Mother's weight		
Average weight (kg)	59.9	31.7%
<50 kg		9.2%
>90 kg		4.2%
Maternal height		
Average height (cm)	154	33.3%
<140 cm		0.7%
>170 cm		1.3%

Gestational age (GA) was determined by maternal dates and ultrasound when available. Each neonate underwent clinical assessment further to determine the GA, for which we adopted the postnatal Dubowitz assessment protocol.[1] When discrepancies between gestational age were encountered, the clinical Dubowitz estimation was taken as the correct gestational age.

We excluded from the study babies with gross congenital malformations, products of multiple pregnancies and 'small for gestational age' babies. To evaluate the reliability and validity of each measurement and to control for variation shown by each anthropometrician or relevant measuring equipment about 1% of the babies were assessed and measured twice by different observers. For statistical analysis, we used a number of multivariate, bivariate and linear regression techniques to correlate various factors affecting the birth weight and gestational age.

To construct the growth charts the raw data collected in this study was computed with the help of Dr Johan Karlberg of the Department of Anatomy at the University of Gothborg, Sweden. The data from the study was then compared with the Swedish reference values (Table 1).[2] The mean values for weight, length and head circumference were fairly equal between the

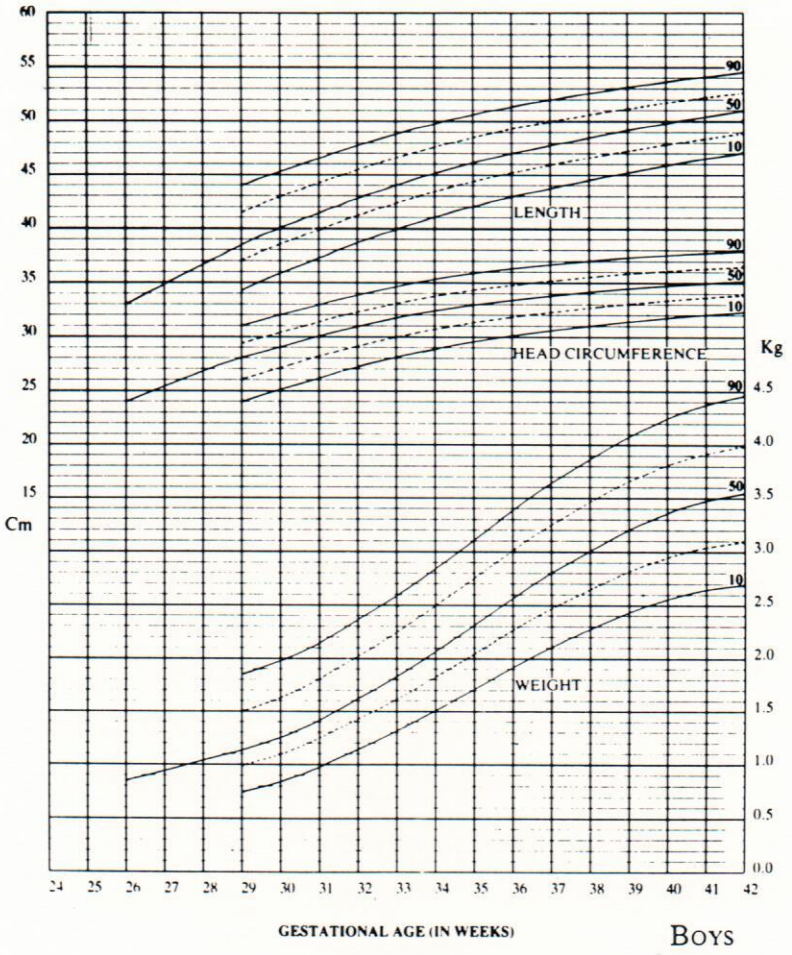

Figure 1. Growth chart for boys.

two groups (Saudi and Swedish) from 36 weeks of gestation onwards.

For construction of intrauterine reference standard values between 26 and 35 weeks of gestation, though our data and that from Sweden were not significantly different we have constructed the charts using only Saudi figures. Standardized mathematical smoothing techniques described by Lawrence *et al.*[2] were adopted to construct the tables and growth charts.

Results

There were a total of 9028 babies enrolled in the study. A description of the total material independent of sex and gestational age is given in Table 2. There were 51.5% boys and 48.4% girls, of which 54.4% were born at 40 weeks of gestation. Socioeconomic and demographic data and obstetrics history are shown in Tables 3a and 3b, respectively. Figures 1 and 2 show the constructed growth charts.

Discussion

Intrauterine growth standards are constructed from birth weight, length and head circumference of babies born at different gestational ages. All such standards have common problems. The population on which to base the standard presents the first problem, i.e. what population should be used to base the standard on? Should each community or institution have its own standard curves or can they be a universal optimal standard curve? Should one have different curves for different races? etc. It remains unclear whether one should prepare intrauterine growth curves for each specific population or use existing ones, and whether one should use the 10th and 90th percentile or two standard deviations from the mean to designate high risk.

It is also questionable whether to exclude all abnormal babies, because one must question

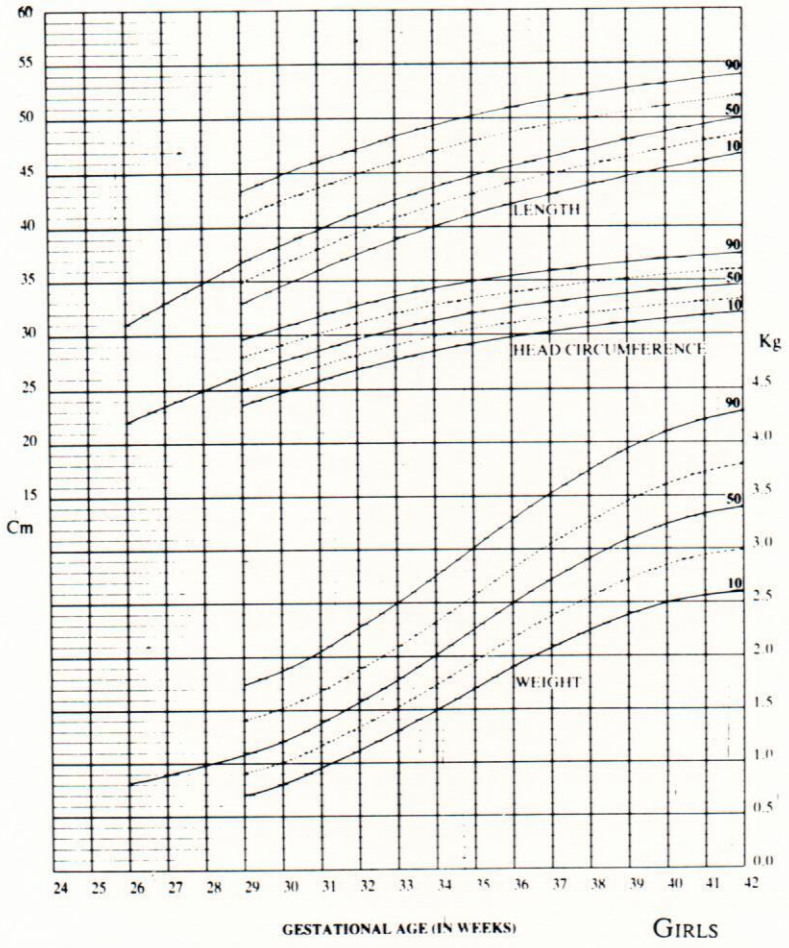

Figure 2. Growth chart for girls

whether a pregnancy resulting in preterm delivery is even normal, and whether conditions resulting in preterm birth affect the growth of the fetus.[3] Conceptual arguments about the inclusion or exclusion of particular abnormalities does not matter in practice if the abnormality is rare enough not to affect the mean standard deviations observed at a particular gestation. However, Babson,[4] Freeman,[5] Tanner[6] and Chen[7] observed that indeed racial and socioeconomic differences are crucial factors which affect reference standard values.[4-7]

We have studied a population of Saudi babies born in four different hospitals covering all socioeconomic strata representative of the country. Moreover, the maternal and domestic data can also be said to be representative of the population as it was similar to the one we found in our larger community-based study on auxiological variance and growth standards of Saudi preschool children.[8] Growth standards derived on this basis are most likely to represent the growth pattern of Saudi babies and we feel that our charts are also likely to be more representative of the Arab population in the Gulf region than those derived from the Western communities, which are in common use at present. We, therefore, recommend that our charts be used throughout the Kingdom of Saudi Arabia and perhaps the Gulf region.

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