GESTATIONAL AGE SPECIFIC WEIGHT, LENGTH AND HEAD CIRCUMFERENCE OF KURDISH NEWBORNS IN SULAIMANI CITY

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ABSTRACT

Objectives

To assess the percentiles (3, 5, 10, 25, 50, 75, 90, 95 and 97%) of weight, length and head circumference for a sample of new-born Kurdish population in Sulaimani and the relation to mothers' age, parity and gestational age.

Methods

Birth weight, crown heal length and head circumference of infants born at gestational age 37–44 weeks in Sulaimani teaching hospital from March 2008 to March 2009 were measured prospectively using standard equipments.

Results

The mean weight, length and head circumference of the male full term baby in the total sample was as followed respectively 3355 kg, 50 cm, 35 cm. The mean weight, length and head circumference of the female full term baby in the total sample were as followed respectively 3260 kg, 49.3cm, 34.5 cm. The median for weight, length and head circumference of the male full term baby were 3355 g (3300–3400), 50 (50–50.2) and 35 (33,5–35). While the median for weight, length and Head circumference of the female full term baby in the total sample were 3260 g (=3200–3306), 49.3 (49–49.5) and 34.5 (34.4–34.6). The anthropometric measures of the new born babies in this study are near that found by the WHO Multicentre Growth Reference Study but higher than less developed countries.

***Keywords*:** *Birth weight, Gestational age, Head circumference, Length, Parity, Percentiles.*

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INTRODUCTION

Primary reference data describing weight, length and head circumference were first published before the 1970's by Thomas *et al.* [1] and growth charts developed by Babson and Benda in 1970's are still recommended and has been used consistently [2]. Small for gestational age is defined as two standard deviations bellow the mean weight for gestational age or bellow the 10th percentile [3]. Large for gestational age is 2 standard deviations above the mean weight for gestational age or above the 90th percentile [3]. Being large or small for gestational age not only predisposes infants to increase requirement for medical intervention but also may affect their ability to respond behaviourally to their parents [4].

Birth weight, length and head circumference are important clinical indicators widely used in evaluation of newborns in addition to evaluation of prenatal growth. Furthermore, they indicate the general well being of the infant, or may identify infants who would need exhaustive assessment and monitoring [5-9]. Infants whose birth weight is too low or too high are at higher risk for morbidity and mortality than those of appropriate weight for gestational age. Furthermore, they have increased risk for complications such as birth trauma, congenital asphyxia and hypoglycaemia [5-9]. Moreover, there is a link between birth weight, placental size and latter risk of hypertension. According to a British study the risk for hypertension is significantly higher in those with lower birth weight combined with larger placental size than others [10]. Another study also showed that reduced fetal growth was associated with increased risk for death from cardiovascular disease in adult life [11]. It is also evident that birth weight has an effect on lung function tests in adulthood and lower birth weight is associated with worse lung function [12], evermore, birth weight and length are also known to be strong predictors of latter adults ' weight and length [13].

In order to be able to follow the changes in health status of the population it is crucial to have basic data regarding reference values for birth weight, height and head circumference for the Kurdish population. This would enable us to follow the child development and identify at risk children at early stage which could reduce the costs as well as facilitate direct preventive actions at early stage.

The aim of this study is to assess the percentiles (3, 5, 10, 25, 50, 75, 90, 95 and 97%) of weight, length and head circumference for a sample of newborn Kurdish population in Sulaimani in relation to gestational age.

METHODS

Setting and sample

In Sulaimani governorate there is one public general maternity hospital and five private hospitals that serve the deliveries in Sulaimani. The general hospital receives the majority of the deliveries while the private hospitals have a small part of the deliveries. In addition to that there are some home deliveries.

The study was done in Sulaimani Maternity Hospital during the period March 2008 to March 2009. During this period there were 6280 deliveries and of those 2953 were females and 3327 were males. The data was collected prospectively by two paediatricians and each paediatrician collected the data on separate days with an assistant who helped during the procedure of measurements. The assistants were nursing staff at the neonatal care unit at the hospital.

Only neonates with gestational age 37–44 week gestation were included. Neonates with evident major congenital anomalies, gestational age impossible to determine with accuracy, or when the infants gestational age as measured after delivery by the new Ballard score wasn't with in ± 2 weeks of the estimated gestational age as measured from the last menstrual period, infants of diabetic mother's and ethnicity other than Kurdish were excluded.

The parity of the mothers was also taken in order to asses if there were any relation between the parity and anthropometric measure of the newborns. A primipara is a woman who has delivered one child past the age of viability. Multiparous is a woman who has delivered one or more children past the age of viability [14].

Measurements

Weight

Weight was measured using an electronic weight scale (Seca) with the child positioned horizontally on the scale with his under wear and without his diaper. The weight was read when the infant stopped moving and the reading was done to the nearest 10 g.

Length

Length was measured by a wooden Infantometer, which had a fixed headboard and a movable footboard that is perpendicular to the surface of which the baby is lying and the Infantomer has a measuring surface marked in millimetres. The infant was placed by the researchers and an assistant while the head was aligned straight with the external ear in perpendicular line with the eyes of the baby, gentle force was used to extend the knee of the newborn, and then the measurement recorded within the nearest 0.1 cm.

Head circumference

Head circumference was measured by a non extendable tape measure, measurements were repeated three times and the largest diameter was recorded. All measurements were done during the first 24–48 hour of birth.

Assessment of gestational age

The gestational age was based on the last menstrual period clearly remembered by the mother and was recorded to the nearest week or the early ultrasound examination done before 20 weeks of gestation. The gestational age of each infant was further assessed by postnatal examination using the new Ballard score [(3)], to assess the physical and neurological maturity of the neonate. This was done to further document the gestational age, those who were not within ± 2 week of the gestational age measured by menstrual period were excluded from the research.

Pre-test

The first ten infants were examined by both researchers independently to assess the degree of agreement between the two researchers. This showed no major difference between the two researchers and therefore each researcher could exam neonates separately on different days.

Statistical method

The data were analyzed using Stata software [(15)]. Basic statistics were used to calculate the prevalence and the means and the 3rd, 5th, 10th, 25th, 50th, 75th, 95th and 97th percentiles with 95% Confidence intervals (95% CI) for weight, length and head circumferences were calculated.

Ethical consideration

The participation has been voluntary and the project has been conducted in line with Helsinki Declaration. Furthermore, the study was approved by the Ethics Committee at the Medical College, Sulaimani University.

RESULTS

The study included 524 (54.9%) male and 430 (45.1%) female infants. The mean weight for singleton infants was 3342.9 g and the median was 3300 g and the range was 2000–5750 g. The mean length was 49.6 cm and the median was 49.7 cm and the range was 40.7–56 cm. For the head circumference the mean was 34.8 cm and the median was 35 cm and the range was 31–38.5 cm.

The mean age for mothers was 28.7 year and the age ranged from15 to 46 years. While the mean age for nulliparous mothers was 24 years. The number of pregnancies ranged from 1 to 12 pregnancies and the range of parities varied from zero to 9 parities with the last pregnancy excluded. The registered gestational ages were from 36 week to 43 weeks pregnancy and the median was 40 weeks.

Birth weight, length and head circumference for the total sample is shown in table 1. The median weight for the whole sample was 3300 g, for males' 3355 g and for females 3260 g. The median length for the neonate in the sample was 49.7 cm, for males 50 cm and for females 49.3 cm. The median head circumference for the sample was 35 cm, for males 35 cm and for females 34.5 cm.

Birth weight, length and head circumference by mother's age

Birth weight

The median weight for newborns was highest in mothers aged less than 20 years (3300 g) followed by mothers aged 35 years and older and the lowest weight was in those mothers whose age was between 20 and 34 years (table 2a). The median weight for males whose mothers were aged less than 20 years was 3300 g and 3350 g for those whose mothers were aged 20 to 34 years and 3350 g for those whose mother was aged 35 years and more. The figures for females were 3400, in those whose mother were aged less than 20 years and between 20 and 34 years while the figure was 3400 in those whose mother were 35 years and more.

Length

Table 2b shows the percentiles of length by mother's age. The median length was 49.7 cm regardless of mother's age but it is obvious that male newborns had a slightly longer median length. In mothers aged less than 20 years the median length in males was 49.8 cm but in females 49.5 cm. Male newborns were one cm longer than females in those mothers between 20–34 and 35 years and older.

Head circumference

The median head circumference for newborns in the total sample was 35 cm regardless of mothers age and this was true for males but for females the figures were 34.5, 34.4 and 34 cm in mothers aged less than 20, 20–34 and 35 years and more respectively (table 2c).

Birth weight, length and head circumference by parity

Birth weight

The median weight for newborns was 3290, 3330 and 3240 g in those with nulliparous, multiparous and grand multiparous respectively (table 3a). For males the figures were 3320, 3375 and 3375 cm in the respective parity groups and the figures for females were 3230, 3295 and 3265 g respectively.

Length

The median length for the whole sample was 49.5, 49.6 and 50 cm in nulliparous, multiparous and grandpara respectively (table 3b). The figures for males were 50, 50 and 50.3 cm respectively while the figures for females were 49, 49.3 and 50 cm respectively.

Head circumference

The median head circumference was 34.8, 35 and 35 cm in nulliparous, multiparous and grand multiparous respectively (table 3c). The figure for males was 35 cm regardless of parity but in females the figures were 34.3, 34.5 and 35 cm in nulliparous, multiparous and grand multiparous respectively.

Birth weight, length and head circumference by pregnancy week

Birth weight

The median weight in pregnancy week 38 was 3040 g and it is increasing by pregnancy week in the whole sample as well as in both sexes except in males and week 42 in which the weight is lower in this group than in weeks 40 and 41 (table 4a). The median weight in week 40 is 3400 g in the total sample, 3490 g in males and 3380 g in females. In week 42 the median is 3600 g for the whole sample, 3460 g in males and 3650 g in females, females at this week seem to have heavier weights than males but this is due to the fact there were about 2 outliers with extremes of weight and length in the female sample of that gestational age.

Length

The median length increases by pregnancy week in both sexes. The median length in week 40 in the total sample is 50 cm, 50.4 cm in males and 49.8 cm in female respectively (table 4b). In week 42 the median length in the total sample 50.5 cm, 50.3 cm in males and 50.9 cm in females.

Head circumference

The head circumference increase slightly by pregnancy week in both sexes and the median head circumference in week 40 in the total sample is 35 cm, 35.3 cm in males and 34.5 cm in females respectively (table 4c). In pregnancy week 42 the median head circumference is 35.4 cm, 36 cm in males and 35.2 cm in females respectively.

Table 1. Birth weight, length and head circumference in the total sample and in both sexes.

	Percentile	Mean Weight (g)	95%CI	Mean length (cm)	95%CI	Mean HC (cm)	95%CI
Total		952		951		927	
	3	2490	2400-2580	46	45.5-46.1	32	32- 32.5
	5	2600	2530-2637	46.5	46-46.5	32.5	32.5-33
	10	2750	2700-2800	47	47-47.2	33	33-33
	25	3012.5	3000-3059	48.3	48-48.5	34	33.9-34
	50	**3300**	**3283-3350**	**49.7**	**49.5-50**	**35**	**34.8-35**
	75	3650	3600-3700	51	50.9-51	35.5	35.5-36
	90	3970	3900- 4000	52	51.9-52	36.5	36.2-36.5
	95	4150	4100-4227	52.5	52.1-53	37	36.8-37
	97	4300	4200-4424	53	53-53.3	37.3	37-37.5
Male, n		522		521		407	
	3	2450.7	2320-2523	46	45-46.5	32.5	32-33
	5	2563	2472.6-2674	46.5	46.1-47	33	32.5-33
	10	2765	2700-2845	47.4	47-47.8	33.4	33-33.5
	25	3092.5	3020-3116	48.8	48.5-49	34.2	34-34.4
	50	**3355**	**3300-3400**	**50**	**50-50.2**	**35**	**35-35**
	75	3700	3643-3753	51.3	51-51.5	36	36-36
	90	3987	3925- 4081	52.1	52-52.5	36.5	36.5-37
	95	4190	4100-4285	53	52.5-53.2	37.3	37-37.5
	97	4315.5	4200-4430	53.3	53-53.8	37.5	37.3-38
Female, n		429		429		419	
	3	2577	2466-2620	45.5	45- 46	32	32-32.5
	5	2620	2590- 2662	46	45.5-46.5	32.5	32-32.5
	10	2710	2666-2769	47	46.5- 47	33	32.5-33
	25	2970	2900-3000	48	47.7-48.2	33.5	33.2-33.8
	50	**3260**	**3200-3306**	**49.3**	**49-49.5**	**34.5**	**34.4-34.6**
	75	3580	3500-3630	50.5	50-50.8	35.3	35-35.5
	90	3900	3811-4000	51.3	51-51.5	36	36-36.1
	95	4110	4000-4285	52	51.5-52	36.5	36.1-37
	97	4291	4120-4702	52	52-53	37	36.5-37

Table 2a. Weight by sex and mothers age.

Mothers age (year)		**<20**		**20-34**		**≥35**	
	Percentile	**Mean Weight**	**95%CI**	**Mean weight**	**95%CI**	**Mean weight**	**95%CI**
Total, n		59		558		159	
	3	2616	2600-2758	2495.	2255-2600	2580	2272-2694
	5	2680	2600-2822	2620	2515 2690	2620	2497-2778
	10	2800	2634-2930	2750	2700-2820	2800	2654-2900
	25	3000	2900-3200	3000	3000-3073	3040	2978-3130
	50	**3330**	**3200-3496**	**3300**	**3260 3350**	**3320**	**3250-3400**
	75	3610	3500-3800	3650	3600-3718	3610	3500-3782
	90	3850	3742- 4077	3941	3900-4020	4020	3912-4183
	95	4000	3836- 4350	4191	4100-4293	4220	4047-4662
	97	4150	3850-4350				
Male, n		31		314		84	
	3	2680	2680-2794	2465	2194-2633	2417	2170-2817
	5	2692	2680-2887	2623	2461-2726	2610	2215-2900
	10	2754	2680-2933	2800	2709-2900	2895	2569-3000
	25	2940	2792-3200	3100	3020-3130	3133	3000-3261
	50	**3300**	**3120-3430**	**3350**	**3300-3469**	**3400**	**3310-3505**
	75	3752	3326-3843	3700	3627-3770	3784	3600-3970
	90	3848	3765-4350	4000	3920-4150	4130	3970-4239
	95	4200	3814-4350	4200	4100-4396	4228	4120-5494
	97	4350	3842-4350	4382	4200-4614	4386	4171-5750
Female, n		28		243		75	
	3	2600	2600 -2862	2600	2600-2862	2516	2191-2625
	5	2609	2600 2913	2682	2600-2913	2620	2488-2690
	10	2782	2600-3073	2782	2600-3073	2704	2660.-2784
	25	3105	2822-3355	3505	2822-3355	2960	2900 3000
	50	**3400**	**3214-3551**	**3400**	**3214-3551**	**3230**	**3177-3300**
	75	3607	3500-3822	3607	3500-3822	3580	3486-3688
	90	3854	3614-4000	3854	3614-4000	3900	3800- 3998
	95	3950	3681-4000	3950	3681-4000	4100	3910-4268
	97	4000	3769-4000	4000	3769- 4000	4237	4067- 4447

Table 2b. Length by sex and mothers age.

Mothers age (year)		<20		20-34		≥35	
	Percentile	**Mean length**	**95%CI**	**Mean lengthy**	**95%CI**	**Mean length**	**95%CI**
Total		58		559		158	
	3	46.9	46.5-47.1	46	45-46.2	46	43.9-46.5
	5	47	46.5-47.5*	46.3	46-46.8	46.3	45.7-47
	10	47.4	47-48	47	47 47.3	47.1	46.5-47.5
	25	48.4	47.5-49.5	48.5	48.0-48.7	48.3	47.9-48.9
	50	**49.7**	**49.5-50.1**	**49.7**	**49.5 -50**	**49.7**	**49.3-50**
	75	50.5	50.1-51.3	51	50.7-51.	51	50.5 51
	90	51.4	51-52.2	52	52-52	52	51.5-52.4
	95	52.2	51.3-53	53	52-53	52.8	52-54.3
	97	52.2	51.3-53	53	52-53	52.8	52-54.3
Male, n		30		315		83	
	3	47	47-47.7	46.2	44.9-46.6	46	45-47.2
	5	47	47-48	46.5	46.1-47.2	46.1	45.2-47.5
	10	47.4	47-48.1	47.8	47-48	47.5	46-48
	25	48.2	47.6-49.6	49	48.5-49	49	47.9-49.5
	50	**49.8**	**49-50.5**	**50**	**50-50.3**	**50**	**49.7-50.7**
	75	50.8	50.2-52	51.3	51-51.7	51.5	51-52
	90	52	50.9-53	52.1	52-53	52.68	52-54.1
	95	52.6	51-53	53	52.5-53.3	54	52.5-55.7
	97	53	52-53	53.2	53-53.7	54.5	53.2-65
Female, n		28		243		75	
	3	46.5	46.5-47.3	45.5	45-46	45.64	43-46.6
	5	46.725	46.5-47.5	46	45.5-46.5	46.24	43.1-46.8
	10	47	46.5-48.3	47	46.2-47	46.7	46.1-47.5
	25	48.625	47.1-49.5	48	47.5-48.2	48	47.5-48.5
	50	**49.5**	**49.5-50.1**	**49**	**49-49.5**	**49**	**48.6-49.7**
	75	50.375	49.9-51.2	50.3	50-50.5	50.2	50-51
	90	51.3	50.4-52.2	51.4	51-51.5	51	50.7-514
	95	51.795	51.1-52.2	51.8	51.5-52.3	51.26	51-52
	97	52.2	51.3-52.2	52	51.5-53	51.5	52-52

Table 2c. Head circumference (HC) by sex and mothers age.

others age (year)		**<20**		**20-34**		**≥35**	
	Percentile	**Mean HC**	**95%CI**	**Mean HC**	**95%CI**	**Mean HC**	**95%CI**
Total, n		55		542		155	
	3	32.5	32.5-33	32	32-32.5	32.1	31.9-32.9
	5	32.9	32.5-33	32.5	32-33	32.5	32-33
	10	33	32.5-34	33	33-33	33	32.5-33.3
	25	34	33.5-34.5	34	33.5-34	34	33.5-34.3
	50	**35**	**34.5-35.5**	**35**	**34.5-35**	**35**	**34.5-35**
	75	36	35.5-36.2	35.5	35.5-36	35.8	35.5-36
	90	36.5	36-37.5	36.2	3636.5	36.9	36.3-37.5
	95	37.26	36.4-38.1	36.97	36.5-37	37.5	37.0-38.2
	97	37.692	36.5-38.1	37	3737.3	38	37.5-38.5
Male, n		29		305		81	
	3	32.5	32.5-34	32.1	32-33	32.73	32-33.2
	5	32.75	32.5-34.4	33	32-33	33	32.1-33.5
	10	33.5	32.5-34.5	33.3	33-33.5	33.5	33-34
	25	34.5	33.8-35	34	34-34.4	34.5	34-34.8
	50	**35**	**34.5-36**	**35**	**35-35.2**	**35**	**35-35**
	75	36.2	35.5-37	36	36-36	36	35.7-36.5
	90	37.2	36.4-38.1	36.5	36.3-37	37.5	36.5-38.1
	95	37.8	36.5-38.1	37	36.9-37.3	37.95	37.5-38.5
	97	38.1	36.7-38.1	37.3	37-37.6	38.354	37.5-38.5
Female, n		26		236		74	
	3	32.5	32.5-33	32	31.9-32.5	32	31.8-32.5
	5	32.675	32.5-33	32	32-32.5	32.15	31.8-33
	10	33	32.5-33.8	33	32.5-33	32.75	32-33
	25	33.9	33-34.3	33.5	33-33.5	33.5	33-34
	50	**34.5**	**34-35.5**	**34.4**	**34-34.5**	**34.35**	**34-35**
	75	35.5	34.6-36	35	35-36.3	35	35-35.8
	90	36	35.5-36.2	36	35.5-36	36.4	35.5-37.1
	95	36.13	35.8-36.2	36	36-36.5	36.9	36.3-38
	97	36.2	36-36.2	36.3	36-37	37.425	36.5-38

Table 3a. Weight by parity.

Mothers age (year)		Nulipara		Multipara		Grand para	
	Percentile	**Mean Weight**	**95%CI**	**Mean weight**	**95%CI**	**Mean weight**	**95%CI**
Total, n		269		528		34	
	3	2455	2207-2526	2597	2481-2635	2022	2000-2750
	5	2520	2421-2600	2659	2600-2711	2323	2000-2801
	10	2630	2600-2750	2800	2733-2900	2750	2000-3012
	25	2950	2900-3020	3050	3000-3100	3035	2763-3202
	50	3290	3200-3350	3330	3300-3390	3240	3143-3502
	75	3560	3500-3639	3707.5	3630-3750	3560	3353-3965
	90	3853	3780-3947	4000	3948-4100	4015	3676-4140
	95	4015	3900-4200	4241	4119-4376	4110	3915-4140
	97	4200	4000-4441	4400	4275-4694	4138	3987-4140
Male, n		174		282		14	
	3	2393	2147-2520	2540	2186-2700	2540	2186-2700
	5	2490	2380-2613	2692	2515-2804	2692	2515-2804
	10	2665	2520-2810	2900	2750-2960	2900	2750-2960
	25	3000	2900-3115	3100	3050-3135	3100	3050-3135
	50	**3320**	**3200-3405**	**3375**	**3300-3450**	**3375**	**3300-3450**
	75	3633	3526-3750	3733	3670-3820	3733	3670-3820
	90	3895	3800-4000	4020	3970-4182	4020	3970-4182
	95	4100	3915-4200	4264	4120-4404	4264	4120-4404
	97	4198	4000-4385	4400	4231-4660	4400	4231-4660
Female, n		121		246		20	
	3	2480	2180-2600	2608	2491-2662	2750	2750-2982
	5	2600	2322-2620	2637	2590-2700	2753	2750-3015
	10	2622	2600-2750	2750	2693-2897	2819	2750-3111
	25	2920	2766-3000	3000	2919-3073	3105	2802-3238
	50	**3230**	**3100-3316**	**3295**	**3200-3350**	**3265**	**3129-3527**
	75	3500	3400-3588	3632.5	3540-3740	3530	3317-4048
	90	3776	3610-3926	4000	3900-4095	4026	3530-4100
	95	3945	3786-4410	4236	4021-4651	4097.5	3674-4100
	97	4177.8	3890-4900	4518	4156-4895	4100	3820-4100

Table 3b. Length by parity.

Mothers age (year)		Nulipara		Multipara		Grandpara	
	Percentile	**Mean length**	**95%CI**	**Mean lengthy**	**95%CI**	**Mean length**	**95%CI**
Total, n		295		528		43	
	3	45.4	44.8-46	46.2	45.5-46.5	44.9	44.8-47.5
	5	46	45.2-46.5	46.5	46.3-47	45.7	44.8-48.2
	10	47	46.5-47.2	47.2	47-47.5	47.3	44.8-48.5
	25	48	48-48.5	48.5	4848.8	48.9	47.7-49.8
	50	**49.5**	**49.5-50**	**49.6**	**49.5-50**	**50**	**49.5-50.6**
	75	51	50.5-51	51	50.9-51	51	50.5-51.9
	90	52	51.6-52.1	52	51.9-52	52.4	51.1-53.5
	95	52.2	52-53	52.8	52.1-53.3	53.1	51.6-53.5
	97	53	52.2-53	53.3	53-54	53.5	52.1-53.5
Male, n		173		282		14	
	3	45	43.5-46.3	46.5	46-47	44.8	44.8-47.7
	5	45.9	44.8-47	46.8	46.4-47.2	44.8	44.8-48.5
	10	47.2	46.3-47.8	47.5	47-48	45.4	44.8-49.3
	25	48.7	48-49.0	49	48.4-49	48.9	44.9-50.2
	50	**50**	**49.7-50.3**	**50**	**49.9-50.3**	**50.3**	**48.9-51.7**
	75	51.4	51-51.8	51.2	51-51.5	51.7	50.3-53.4
	90	52.1	52-52.5	52.2	52-53	53.2	51.3-53.5
	95	52.7	52.2-53	53.3	52.5-54	53.5	51.9-53.5
	97	53	52.5-53.1	53.9	53.2-54.5	53.5	52.2-53.5
Female, n		121		246		20	
	3	45.8	45-46.5	45.5	44.1-46.5	47	47-48.2
	5	46	45.1-46.6	46.4	45.5-47	47.0	47-48.3
	10	46.7	46-47	47	46.5-47.3	47.6	47-49
	25	47.5	47.06304	48	47.8-48.5	48.7	47.5-50
	50	**49**	**48.5-49.5**	**49.3**	**49-49.5**	**50**	**49.3-50.9**
	75	50	49.8-50.5	50.5	50-51	51	50.2051.5
	90	51	50.7-51.4	51.4	51-52	51.5	51-53
	95	51.5	51-51.7	52	51.5-52.7	52.9	51.1-53
	97	51.5	51.2-52.2	52.5	52-53.9	53	51.5-53

Table 3c. Head circumference (HC) by parity.

Mothers age (year)		Nulipara		Multipara		Grandpara	
	Percentile	**Mean HC**	**95%CI**	**Mean HC**	**95%CI**	**Mean HC**	**95%CI**
Total, n		290		513		34	
	3	32.5	32-32.5	32	32-32.5	32.5	32.5-33.4
	5	32.5	32.5-33	32.5	32-33	32.5	32.5-33.5
	10	33	33-33	33	33-33.5	33.2	32.5-34
	25	33.8	33.5-34	34	34-34	34	33.4-34.6
	50	**34.8**	**34.5-35**	**35**	**34.8-35**	**35**	**34.4-35.1**
	75	35.5	35.3-36	35.8	35.5-36	35.5	35-36
	90	36.4	3636.5	36.5	36.2-36.7	36.3	35.5-38
	95	37	36.5-37.2	37	36.837.5	37.6	36-38
	97	37.1	3737.6	37.5	37-37.5	38	36.1-38
Male, n		170		273		14	
	3	32.5	31.7-33	32.1	32-33	32.5	32.5-33.5
	5	33	32.4-33.2	33	32-33.3	32.5	32.5-34.1
	10	33.3	33-33.5	33.5	33.2-33.8	32.5	32.5-34.5
	25	34	34-34.4	34.3	34-34.5	34.4	32.5-35
	50	**35**	**35-35**	**35**	**35-35.2**	**35.0**	**34.4-35.5**
	75	36	35.8-36	36	35.8-36	35.5	35-37.4
	90	36.5	36.4-37	37	36.5-37	36.8	35.5-37.5
	95	37.1	36.5-37.6	37.5	3737.5	37.5	35.5-37.5
	97	37.5	37-38.0	37.5	37.538.3	32.5	32.5-33.5
Female, n		119		240		20	
	3	32.1	31.5-32.5	32	31.8-32.5	33	33-33.5
	5	32.5	32-33	32.5	32-33	33.0	33- 33.9
	10	33	32.5-33	33	32.5-33	33.4	33-34*
	25	33	33-33.5	33.8	33.5-34	34	33.4- 35
	50	**34.3**	**34-34.5**	**34.5**	**34.4-35**	**35**	**34-35**
	75	35	35-35.4	35.5	35.2-35.7	35.4	35-36.5
	90	35.6	35.5-36	36	36-36.2	36.5	35.2-38
	95	36	35.6-36.9	36.5	36.0-37	37.9	35.6-38
	97	36.4	36-37	37	36.5-37.3	38	36.0-38

Table 4a. Birth weight in relation to pregnancy week

Week	Percentile	Total		Male		Female	
		Mean	**95%CI**	**Mean**	**95%CI**	**Mean**	**95%CI**
38		N=139		N=71		N=68	
	3	2200	2122- 2430	2192	2110-2425	2208	2180-2498
	5	2320	2189- 2499	2272	2110-2500	2392	2180-2547
	10	2500	2380-2627	2492	2207-2792	2527	2301-2626
	25	2770	2665- 2830	2830	2666-2957	2693	2614- 2800
	50	**3040**	**2934-3126**	**3100**	**3015-3227**	**2935**	**2824-3100**
	75	3350	3200-3457	3420	3313-3621	3208	3130-3444
	90	3650	3563- 3800	3780	3591- 4010	3604	3381- 3749
	95	3800	3731-4031	3918	3780- 4100	3736	3515- 4160
	97	3986	3780=4150	4020	3801-4100	3796	3642-4160
39		N=266		N=145		N=121	
	3	2521	2213- 2608	2501	2117-2610	2600	2160 2700
	5	2600	2520-2700	2586	2388-2724	2621	2353- 2710
	10	2744	2639- 2781	2750	2600-2900	2714	2625- 2780
	25	2967.5	2900-3030	3060	2938- 3130	2900	2790 2973
	50	**3235**	**3155- 3300**	**3300**	**3222-3356**	**3140**	**3030 3244**
	75	3500	3470-3600	3535	3478- 3762	3500	3363-3594
	90	3900	3800-3980	3928	3810-4072	3800	3600-3952
	95	4019.5	3900-4333	4135	3970 4428	3990	3800-4240
	97	4278.7	4000-4584	4381	4000-5500	4120	3900 5370
40		N=287		N=156		N=131	
	3	2593	2469-2744	2477.1	2176- 2800	2630	2489-2862
	5	2734	2581-2900	2608.5	2464- 2900	2736	2602-2920
	10	2928	2880-3000	2921	2800-3008	2924	2745- 3000
	25	3120	3062-3190	3122.5	3060 3211	3110	3000 3200
	50	**3400**	**3354-3500**	**3490**	**3360-3588**	**3380**	**3300 3400**
	75	3730	3650-3779	3750	3657-3820	3650	3516- 3812
	90	4006	3924-4166	4030	3904-4190	4024	3893- 4281
	95	4234	4115-4442	4200	4110-4618	4294	4042- 4791
	97	4367	4208-4714	4368	4190-4821	4460	4221- 5220
41		N=150		N=91		N=58	
	3	2661	2303-2750	2715.2	2560-2909	2521.1	2190-2711
	5	2711	2626- 2927	2798	2609- 3008	2648.5	2190-2990
	10	2990	2740- 3100	2996	2777- 3146	2745	2626- 3103
	25	3208	3148-3287	3220	3144- 3400	3195	3023- 3257
	50	**3500**	**3400-3605**	**3590**	**3480- 3710**	**3390**	**3260 3500**
	75	3803	3714-3922	3890	3750-4009	3652.5	3500 3835
	90	4138	3989-4321	4190	4002-4340	3910	3747 4803
	95	4378	4166-4581	4324	4171- 4473	4612.5	3870- 4900
	97	4489	4260-4885	4414.4	4204- 4480	4861.5	3978-4900
42		N=49		N=22		N=27	
	3	2760	2620-3038	2620	2620-3031	2900	2900 3150
	5	2930	2620-3070	2671	2620 3040	2980	2900-3222
	10	3040	2793-3148	2981	2620-3118	3140	2900-3313
	25	3220	3102- 3398	3110	2976- 3407	3320	3150-3604
	50	**3600**	**3383-3670**	**3460**	**3130 -3670**	**3650**	**3348- 3813**
	75	3835	3670-3995	3695	3536- 3985	3900	3711-4118
	90	4100	3902-4369	3979	3686- 4350	4136	3900- 4400
	95	4275	4012-4400	4298	3920-4350	4320	4055-4400
	97	4375	4104-4400	4350	3929- 4350	4400	4109- 4400

Table 4b. Length in relation to pregnancy week.

Week	Percentiles	Total		Male		Female	
		Mean	**95%CI**	**Mean**	**95%CI**	**Mean**	**95%CI**
38		N=139		N=71		N=68	
	3	45	42.8- 46	45.1	42.8-46.3	45	43-45.9
	5	45.5	44.7-46	45.8	42.8-46.5	45	43-46
	10	46.1	45.5-46.5	46.5	45.5-47.2	46	45-46.5
	25	47.2	46.7- 47.8	47.8	47.2-48.1	46.6	46.4-47.4
	50	**48.8**	**48-49.4**	**49.4**	**48.5-49. 8**	**48.15**	**47.5-49**
	75	50	49.5-50	50.3	50-50.6	49.5	49-49.9
	90	50.5	50.2-51.2	51.2	50.5-52.1	50	49.8-50.6
	95	51.3	50.7-52.1	52.04	51-53	50.284	50-52
	97	52	51-52.9	52.2	51.3- 53	50.779	50-52
39		N=265		N=144		N=121	
	3	46	45.5-46.5	46.1	44.3-46.9	45.8	44-46.5
	5	46.4	46-46.8	46.5	46-47.2	46.0	45.5-46.7
	10	47	46.6-47.3	47.4	46.6-48	46.7	46.1- 47
	25	48	47.8-48.5	48.6	48.2-49	47.5	47.1-48
	50	**49.3**	**49-49.5**	**49.7**	**49.4-50**	**49**	**48.5-49**
	75	50.2	50-50.5	51	50.3-51	49.8	49.5-50
	90	51.3	51-51.5	51.5	51.3-52	50.5	50-51
	95	51.9	51.5-53	52.4	51.5-54	51	50.6-52.7
	97	52.8	51.8-54.6	53.6	52- 55.8	51.6	51-56
40		N=286		N=155		N=131	
	3	46.8	45.4-42 5	46.5	44.4-47	47	44.1-47.3
	5	47	46.8-47.4	47	46.3-5	47.3	46.2-47.6
	10	47.9	47.3-48	47.9	47-48	47.8	47.3-48.2
	25	49	48.5- 49	49	48.4-49.5	48.8	48.5- 49
	50	**50**	**50 -50.5**	**50.4**	**50-50.6**	**49.8**	**49.3-50.1**
	75	51	51 -51.5	51.5	51-52	51	50.5-51
	90	52	52-52.2	52.38	52-53	51.5	51.1-52
	95	52.5	52-53	53	52.5-53.2	52	51.5-52.7
	97	53	52.5-53.3	53	53-53.8	52	51.9-53.9
41		N=150		N=91		N=58	
	3	47	42-47.5	47.4	40.7-48	46.2	45-47
	5	47.1	46.6-47.8	47.8	42.9-48.6	47	45-47.5
	10	48	47.4-48.2	48.3	47.7-49	47.2	46.6-48
	25	49	48.8- 49.6	49.5	49-50.3	48.2	47.7-49.4
	50	**50.5**	**50.3-51**	**51**	**50.5-51.6**	**50**	**49.5-50.5**
	75	51.9	51.3-52	52	52-52.5	51	50.5-51.3
	90	52.5	52-53.2	53	52.5-53.5	51.5	51-51.9
	95	53.4	53-54.4	53.5	53-54.5	51.5	51.4-52.2
	97	53.7	53.1-54.5	54.1	53.3-54.5	52.1	51.5-52.2
42		N=50		N=23		N=27	
	3	43.8	43.7-47.3	43.7	43.7-48.6	43.8	43.8-47.3
	5	44.5	43.7-48.5	44.6	43.7-49.1	44.3	43.8-48
	10	47.4	43.8- 49.1	48.4	43.7-49.8	46.8	43.8-49
	25	49.5	48.5-50	49.8	48.3-50.1	49.2	47.3-50.5
	50	**50.5**	**50 -51**	**50.3**	**50-51.6**	**50.9**	**49.5-51**
	75	51.7	51- 52	52	50.5-52.8	51.5	51-52.9
	90	53	52 -54	52.8	52-53.5*	53	51.7- 55
	95	53.2	52.3- 55	53.4	52-53.5*	54.2	52-55
	97	54.2	53-55	53.5	52.4-53.5*	55	52.4-55

Table 4c. Head circumference (HC) in Centiles (Cis) in relation to pregnancy week (w).

Week	Perentiles	Total		Male		Female	
		Mean	**95%CI**	**Mean**	**95%CI**	**Mean**	**95%CI**
38		N=135		N=70		N=65	
	3	32	31.1-32.5	32	31-32.9	32	32-32.4
	5	32.2	32-32.5	32.3	31-33.1	32.1	32-32.5
	10	32.5	32.3-33	33	32-33.5	32.5	32-33
	25	33.4	33-33.5	33.8	33.5-34	33	32.6-33
	50	**34.4**	**34-34.5**	**34.5**	**34.2-35**	**34**	**33.1-34.5**
	75	35.1	35-35.5	35.3	35 36	35	34.5-35.5
	90	36	35.5-36.3	36	36-36.5	35.5	35.5-36.4
	95	36.3	36-36.8	36.5	36-38.4	36.3	35.5-37.5
	97	36.5	36-38.3	36.5	36-38.4	36.52	35.7-37.5
39		N=259		N=142		N=117	
	3	32	31.6-32.5	32	31.6-32.6	31.9	31- 32
	5	32	32-33	32.5	3233	32	31.6-32.9
	10	33	32.5-33	33	32.5-33.5	33	32-33
	25	33.8	33.5-34	34	33.8-34.2	33.5	33-33.5
	50	**34.5**	**34.4- 34.7**	**35**	**34.5-35**	**34.2**	**34-34.5**
	75	35	35 -35.5	35.5	35-36	35	34.7-35.2
	90	36	36 -36.5	36.5	36-37	35.9	35.3-36.4
	95	37	36.5-37	37	36.5-37.5	36.5	36-37
	97	37	36.8-38.1	37	37-38.5	36.8	36-38.5
40		N=279		N=149		N=130	
	3	32.5	32-33	33	32- 33.3	32.2	31.5-32.5
	5	33	32.5-33	33	32.6-33.4	32.5	32-33
	10	33	33-33.5	33.5	33.1- 34	33	32.5-33.1
	25	34	34-34.3	34.4	34-34.6	34	33.3-34
	50	**35**	**35-35**	**35.3**	**35- 35.5**	**34.5**	**34.5-35**
	75	36	35.5-36	36	36 -36.1	35.5	35-36
	90	36.5	36.2-37	36.8	36.4- 37.3	36	36-36.5
	95	37	36.6=37.5	37.4	37-37.6	36.7	36.1-37
	97	37.4	37-37.7	37.5	37.3- 37.9	37	36.3-37.9
41		N=146		N=88		N=57	
	3	33	32-33.2	33	33- 33.5	32	32 -33
	5	33	33-33.5	33.4	33- 34	32.9	32 -33.5
	10	33.5	33.1-34	34	33.3-34.5	33.2	32.1- 34
	25	34.5	34-35	35	34.5-35	34	33.5-34.5
	50	**35.3**	**35-35.5**	**35.5**	**35.3-36**	**35**	**34.5-35.2**
	75	36	36-36.4	36.5	36-36.8	35.5	35.2-36
	90	37	36.5-37.3	37	36.7- 37.5	36	36 -37
	95	37.4	37-37.5	37.5	37-37.9	36.6	36 -37.2
	97	37.5	37.1-37.9	37.5	37.5- 38	37.1	36- 37.2
42		N=49		N=22		N=26	
	3	33	32.5-33. 9	33.5	33.5-34	26 3	32.5-32.5
	5	33.5	32.5-34	33.6	33.5-34.4	32.9	32.5-34
	10	34	33.1-34.4	34	33.5-35	33.5	32.5-34.4
	25	34.7	34-35	35	34-35.7	34.5	33.5-35
	50	**35.4**	**35-35.8**	**36**	**35-36.3**	**35.2**	**34.7-35.5**
	75	36.1	35.8-36.5	36.5	36-38	35.8	35.3-36.3
	90	37	36.3-38	38	36.-38.1	36.4	35.8-37
	95	38	36.8- 38.1	38.1	37.1-38.1	36.8	36-37
	97	38.1	37-38.1	38.1	37.8- 38.1	37	36.2-37

DISCUSSION

Comparing the results of the current study with weight charts of Canadian babies born at the same gestational age, the Canadian babies are significantly heavier than in this study [15]. The 50th percentile for males weight at 40th week gestational age was 3600 g and for females was 3470 g in the Canadian example compared to lower figures in the current study (3490 g in male and 3280 g in females) [16]. This may be due to the combined effect of genetics and higher socioeconomic standard in a more developed country.

The results shown in this study are near to the World Health Organization (WHO) Multicentre Growth Reference Study results in which the 50th percentile for the weight of the new born sample in male is 3300 g and the length is 49.9 cm, in this study the median weight for males was 3355 g and the median length was 50 cm. The WHO median for weight of female newborn was 3200 g and length was 49.1 cm. In this study the median for the female sample for weight and length were 3260 g and 49.3 cm respectively. This is showing that infants in this study are marginally heavier and longer than that reported by WHO [17]. The results might have been close due to the fact that the WHO study includes both developed and developing countries and this might have given a more averaged result.

When comparing the results shown in this study to the tables and charts from the Center of Disease Control in USA (CDC), the median weight in CDC sample is higher (3530 g for males and 3399 for females) compared with the current study (3355 g and 3260 g respectively) [17].

But the length of infants in this study is almost similar with the CDC measurements. The length for males was 49.98 cm and for females was 49.28 cm according to CDC compared to 50 cm and 49.3 cm respectively in this study [17].

The median head circumference in the CDC tables was 35.8 cm for males and 34.7 cm for females compared to 35 cm for males and 34.5 cm for females' infants in this study meaning that Kurdish infants had a smaller head circumference compared to Americans and the difference is more obvious in male [17].

Important to mention that when comparing the data for a particular gestational age is more accurate than comparing the median of the whole samples although the range of full term by definition is the same (37+4 days– 42 weeks) but the samples may have contained 43 or 44 weeks, on the other hand in this study bellow 37 gestational weeks and above 43 were excluded because of the small number of these gestation ages in the sample.

In a study done in Hong Kong in 1997 in which 95% of the population were of Chinese ethnic origin, updated gestational age specific charts were done, the 50th percentile of 40 week gestational age of their sample for males was 3415 g, 51.1 cm 34.7 cm for weight, length and head circumference respectively [18]. This shows different body proportion than the sample in this study in which the weight and head circumference of infants were higher (3490 g, 35.3 respectively) but the length was less (50.4 cm) for the corresponding gestational age. The same difference in body proportions was found comparing the females in the same study (3278 g, 50.2 cm and 34 cm) for the weight, length and head circumference respectively, while the corresponding results for females of the same gestational age in this study was 3380 g and 49.8 cm, 34.5.

When comparing the results of this study with a study done in Jahrom in Iran which was a longitudinal study involving 597 children followed from birth to 2 years, showed that these babies were a bit lighter but somewhat taller than that found in this study [19]. The mean weight and length for males in the Iranian study was 3260 g and 51.1 cm compared to the weight 3355 g and length 50 cm in our study. The figures for females were 3210 g and 50.8 cm respectively compared to the figure 3260 g and 49.5 cm in this study [19]. However, in both studies males had higher weight and length.

A study done in a state hospital in the Anatolian part of Istanbul, Turkey, birth weight length and head circumference of 3688 full term neonates were reported, the mean weight of the whole sample regardless of male and female and gestational age was 3334 g, median length was 48.3 cm, median head circumference was 34.4 cm [20]. This was lower than the results in this sample regardless of gestational age and sex which was 3300 g, 49.7 cm, and 35 cm respectively.

In another study from Addis Ababa in Ethiopia a total of 4206 live births were studied for their weight, length and head circumference from the period of July 1996 to January 1997, the mean birth weight of singleton life births was 3065 g, the mean length was 48.6 cm, and the mean head circumference was 34.4cm [21]. This seems to be significantly lower than the results in this study (weight =3300 g, length=49.7cm and head circumference=35cm respectively).

When we compare our study to a local study performed in Erbil maternity and children hospital in which it took a randomly selected sample of healthy newborns with in the first 24 hour of their birth, for male infants the mean of the whole sample was 3329 gm., 49.9 cm and 34.55 cm for weight, length and head circumference respectively. The mean for males in our sample was 3355 gm., 50 cm, and 35 cm for weight, length and head circumference respectively, showing that the newborns were smaller when compared to the current study. Females were smaller than males in both studies but again they were larger in our study. The mean for females in the Erbil study had the following figures; 3231 gm, 49.27 cm, 34.05 cm, and in this study comparative figures were; 3260gm, 49.3cm, 34.5cm for the weight, length and head circumference respectively [22]. The study was performed in 2002 this difference may be due to the improvement in socioeconomic status in Kurdistan in general in the last 8 years.

Another study done in the south of Iraq in Al Basrah published in 1983 estimated the mean birth weight of Iraqi children based on measurements taken from a sample of district hospitals and one specialist hospital from Southern Iraq. Investigation was confined to 1,170 singleton births to mothers who had no obvious complications during their antenatal period. The mean birth weight was found to be 3.32 kg (males=3.38 kg and females=3.26kg) [23]. The comparative results in our study was 3.300 kg for the mean of the whole sample and 3.35 kg for males and 3.26 kg for females, showing a marginal difference mainly in the males which was slightly lower in our sample. Although the comparison is between two different ethnic groups in Iraq the results are quite similar, may due the good economical state of Iraq in the 1980's which then declined dramatically with the Embargo in the 1990's, to rise again in the north of Iraq in the last 10 years due to the relative stability in the region and the economic rise in comparison to the other parts of Iraq. In agreement with all the previous other studies females where lighter than males, the study also shows increase in birth weight with increase in parity up to the 5th parity, our study also showed a similar result.

When comparing the anthropometric measurements with the maternal age it is obvious that both length and head circumference are not affected by maternal age, but birth weight is slightly affected showing that those born to mothers between 20–35 are marginally smaller than those bellow 20 and those above 35, this may be due to coincidence as the numbers of mothers above 35 and those bellow 20 are not large enough.

The weight of the infants increased with parity in this study but this advantage was lost after the 4th pregnancy as they had slightly lighter offspring's than the rest of the sample. A similar result was found in the study performed in Erbil there was increase in anthropometric measures of new-borns until the fourth pregnancy [22]. The study done in Basrah also showed an increase in birth weight up to the 5th pregnancy [23] This may be due to the egsuasion of maternal resources or the small gaps between pregnancies in grand multipara's.

The anthropometric measures of the new born babies in this study are near that found by the WHO Multicentre Growth Reference Study. It was significantly higher than less developed countries as in Ethiopia. Comparison between different populations shows that there are different body proportions in different population.

We recommend that anthropometric measures of weight, length and head circumference all be done routinely to all new-borns babies as it is a base line for monitoring their growth later in life, and it's a pressures resource for further researches concerned with this aspect.

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