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A Study of Effects of Maternal Anaemia on Anthropometric Measurements of Newborns

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Abstract
Background: The health-conscious world community has come to realize that anaemia, the majority of which is due to iron deficiency, has serious health and functional consequences, is widespread especially among tropical-low income populations and that most of its nutritional component is controllable with a very high benefit/cost ratio. Women of fertile age and pregnant-lactating as well as their infants and young children are particularly affected.
Aims & Objectives: The aim of present study to find out the effects of maternal anaemia on Anthropometric measurements of newborn in western Rajasthan, India.
Methods: The Study carried was carried out on 938 mothers and their newborn at Umaid Hospital, Dr. Sampurnanand Medical College Jodhpur, and Rajasthan. Out of 938 mothers 90(9.58%) were anaemic and 848 were found normal (90.40%). Anthropometric measurements of newborn included the weight, length, head, mid arm, chest, thigh, calf circumferences and skin fold thickness.
Results: In the present study 9.59% of mothers were anaemic. Maternal anaemia strongly influences mean birth weight and LBW rate. On the multivariate analysis by ANOVA test, maternal anaemia had highly significant ($p<0.01$) effects on birth weight, chest and mid arm circumference and significant ($p<0.05$) effect on length and calf circumferences of neonates.

Keywords: Anthropometry of newborn, effect of anaemia on new born, birth weight, LBW.

Introduction
The health-conscious world community has come to realize that anaemia, the majority of which is due to iron deficiency, has serious health and functional consequences, is widespread especially among tropical-low income populations and that most of its nutritional component is controllable with a very high benefit/cost ratio. Women of fertile age and pregnant-lactating as well as their infants and young children are particularly affected [1].
It has been clearly demonstrated that the anaemic pregnant woman is at greater risk of death during the prenatal period. Close to 500,000 maternal deaths ascribed to childbirth or early post-partum occur every year, the vast majority taking place in the developing world. Anemia is the major contributory or sole cause in 20-40% of such deaths [1]. In many regions anemia is a factor in almost all maternal deaths, and it poses a 5 fold increase in the overall risk of maternal death related to pregnancy and delivery. The risk of death increases dramatically in severe anaemia. The health-conscious world community has come to realize that anaemia, the majority of which is due to iron deficiency, has serious health and functional consequences, is widespread especially among tropical-low income populations and that most of its nutritional component is controllable with a very high benefit/cost ratio. Women of fertile age and pregnant-lactating as well as their infants and young children are particularly affected.
In response to the overwhelming evidence to this effect, world authorities have agreed that a minimal goal is that by the end of this century, anemia in pregnant women must be reduced by 1/3. The more aggressive groups believe that with new approaches for the control of iron deficiency a reachable goal is to reduce iron deficiency anaemia to overall levels below 10% in most populations [2].
Anthropometric studies in children are important: the periodic measurements of anthropometric variables are affected by maternal factors like maternal anthropometric measurement, maternal clinical conditions, maternal life style etc. Fetal, maternal, placental and environmental factors may all influence fetal growth [3, 4]. The aim of our study was to find out the effects of maternal anaemia on anthropometric measurement of newborns.

Material and Method

Present study was conducted at department of Anatomy, Dr. Sampurnanand Medical College Jodhpur, Rajasthan, India. The Study was carried out on 938 mothers and their newborns at Ummed Hospital. The hospital data (obstetric history) and clinical condition were recorded from the tickets of mother and their newborns. We includes normal and anaemic mothers.

The study was performed by measuring the length, weight, head circumference, mid arm circumference, chest circumference, thigh circumference, calf circumference and skin fold thickness of the neonates.

Birth weight with naked neonate in supine position was obtained soon after birth by digital scale with 10 gram subdivision. Other anthropometric variable including chest, head circumferences, thigh circumference, calf circumference, were measured by non-extendable measuring tape, with a width of 1.0 cm and subdivisions of 0.1 cm. and birth length was measured by infentometer, head circumference was obtained by placing tape along the largest occipito-frontal diameter along over the occiput and eyebrow. The chest circumference was measured by placing measuring tape along the point of nipples. The length was measured with the newborn in supine position with full extension of knee and distance between top of head and heel when pressed against a vertical surface and role on a stabilizing board was measured. Mid-arm circumference was measured the circumference perpendicular to the long axis of the upper arm midway between shoulder and elbow. For the thigh circumference the infant lies on back with left leg extended for measurement of thigh circumference. With use of measuring tape, we measured the circumference of the left leg midway between the abdomen-thigh flexure crease and the knee. An assistant is required to assure that the infant is in the correct position. Calf circumference was measured the maximum circumference at the level of the greatest posterior protrusion of the calf. Skin fold was measured over the posterior belly of the triceps muscle of the left arm, half-way between the acromion and the olecranon, on a line passing upwards from the olecranon in the axis of the limb (Tanner and Whitehouse, 1975), with the arm held by the side of the body with the elbow extended.

Ethical clearance and approval for conducting this study was obtained from the ethical committee of the Rajasthan University of Medical Sciences and correspondent hospital's ethical board committees. Prior informed consent was obtained from the mothers participating in this study after full explanation of the study.

The data were analyzed on Graph Pad Prism software and expressed as mean ± S.D (n=6). Statistical multivariate analysis was performed by ANOVA test. The results were considered statistically significant, if $p<0.05$.The level of significance was considered as under:

*Significant $p<0.05$, **highly significant $p<0.001$, Non-significant $p>0.05$.

Observation

Present study was carried out on 938 mothers just after delivery and their new born. Out of 938 mothers 90(9.58%) were anaemic and 848 were found normal (90.40%). The effects of maternal anaemia on new born distribution and anthropometric measurement were showing in table number 1 and 2.

Discussions & Results

New born distribution in anaemic group were 46(51.11%) having normal birth weight, 32(35.55%) with low birth weight, 8(8.88%) very low birth weight, 1(1.11%) was still born and 3(3.33%) were born with congenital anomalies (Table No.1).

Incidence of low birth weight was high in anaemic group compared to non-anaemic group and similar trend was observed in the other studies (Table No.3).

Anthropometric measurements of male newborn of mother of anaemic group were the mean (±SD) value of weight was 2.59 (±0.71) kg, length was 47.04(±3.26) cm, head circumference 34.11(±3.77) cm, mid arm circumference was 9.74 (±1.85) cm, chest circumference was 30.86(±3.6) cm, thigh circumference was 13.74(±3.77) cm, calf circumference was 9.00(±1.67) cm, and skin fold thickness was 3.18(±2.38) mm. While anthropometric measurements of female newborn were the mean (±SD) value of weight was 2.21(±0.61) kg, length was 44.94(±3.49) cm, head circumference was 34.03(±3.1) cm, mid arm circumference was 8.41(±1.71) cm, chest circumference was 28.32(±4.00) cm, thigh circumference was 13.24(±3.01) cm, calf circumference was 8.24(±1.5) cm, and skin fold thickness was 2.68(±1.34) mm (Table No.2)

On the multivariate analysis by ANOVA test, maternal anaemia had highly significant ($p<0.01$) effects on birth weight, chest and mid arm circumference and significant ($p<0.05$) effect on length and calf circumferences of neonates. (Table No. 2)

In the present study mean birth weight in anaemia group was lower than non-anaemic group as we compared with other studies it was similar. No effect of anaemia on birth weight was noted in the study done by Leela Raman (1981) (Table No.4).

Telatar B *et al.* (2009) [15] found that the anthropometric measurements (weight, length, head circumference and chest circumference) of newborn of anaemic and non-anaemic mother group showed a statistically significant difference as we compared with present study it was similar.

Table 1: Comparison of Effects of Maternal Anaemia and Normal Mother on New Born Distribution

S. No.	Distribution of New Born	New born of Normal Mothers				New born of Mothers with Anaemia			
		Male		Female		Male		Female	
		n	%	n	%	n	%	n	%
1	Normal	324	31.80%	242	23.75%	34	3.34%	12	1.18%
2	Low Birth Weight	110	10.79%	91	8.93%	16	1.57%	16	1.57%
3	Very Low Birth Weight	23	2.26%	9	0.88%	5	0.49%	3	0.29%
4	Extremely Low Birth Weight	2	0.20%	3	0.29%	0	0.00%	0	0.00%
5	High Birth Weight	1	0.10%	1	0.10%	0	0.00%	0	0.00%
6	Still Born	6	0.59%	11	1.08%	0	0.00%	1	0.10%
7	Incidence of Congenital Anomalies	21	2.06%	5	0.49%	1	0.10%	2	0.20%
Total		491		367		56		34	

Table 2: Comparison of effects of Maternal Anaemia and Normal Mother on New born Anthropometry

S. No.	New Born parameters	New born of Normal Mothers		New born of Mothers with Anaemia		Statistical Analysis (ANOVA Test)	
		Male Mean±SD	Female Mean±SD	Male Mean±SD	Female Mean±SD	F value	p value
1	Weight(kg)	2.61±0.63	2.59±0.58	2.59±0.71	2.21±0.61	6.32	0.002**
2	Length(cm)	47.26±3.89	46.64±4.01	47.04±3.26	44.94±3.49	3.45	0.03*
3	Head Circumference(cm)	34.42±5.07	33.99±2.87	34.11±3.77	34.03±3.10	0.03	0.96
4	Mid Arm Circumference(cm)	9.97±3.90	9.59±1.95	9.74±1.85	8.41±1.71	6.28	0.002**
5	Chest Circumference(cm)	30.76±8.94	30.57±3.77	30.86±3.60	28.32±4.00	5.95	0.002**
6	Thigh Circumference(cm)	13.77±3.06	13.85±3.03	13.74±3.77	13.24±3.01	0.60	0.54
7	Calf Circumference(cm)	9.12±1.73	9.24±2.42	9.00±1.67	8.24±1.50	3.09	0.04*
8	Skin Fold Thickness(mm)	3.03±1.43	3.10±1.37	3.18±2.38	2.68±1.34	1.31	0.26

Note: p>0.05 (Non significant), * p<0.05 (Significant), **p<0.01(Highly Significant)

Table 3: Comparison of incidence of low birth weight (%) in anemic and non anemic mother Various Studies

Studies	Anemic group	Non anemic group
Swain S (1994)	44.9	20.2
Neeraj Agarwal (2005)	26.2	26.7
Sachdeva P(2009)	37.6	19.6
Lohitha (2012)	43	33
Present study (2015)	35.55	23.67

Table 4: Comparison of maternal anaemia and birth weight

Studies	Anaemic group	Non anaemic group
Leela Raman (1981)	No effect on mean birth weight	
Swain S (1994)	2.66	2.84
Lohitha (2012)	2.57	2.69
Present study (2015)	2.4	2.6

Conclusion

Percentage of normal birth weight, high birth weight, and still born babies was higher in normal mother than anaemic mothers. Incidence of low birth weight, very low birth weight, extremely low birth weight and congenital anomalies was higher in new born of anaemic mothers than normal mothers. Mean value of weight, length, head circumference and mid arm circumference were highest in male new born and thigh circumference and calf circumference were highest in female new born of normal mothers and lowest in female new born of anaemic mothers. Mean value of chest and skin fold thickness was highest in male and lowest in female new born of anaemic mothers.

In the present study 9.59% of mothers were anaemic. Maternal anaemia strongly influences mean birth weight and LBW rate. By improving food intake, improving socio economic condition, literacy, qualitative antenatal care by health staff, early referral of risky cases, provision of Iron and folic acid supplementation, parentaral iron therapy and blood transfusion whenever essential can reduce the incidence of anaemia and there by reduction in LBW. Some of the factors like sex of the baby, religion, birth order are non-modifiable factors determining LBW rate and birth weight.

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