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A Study of Effects of Parity and Gestational Age on newborns

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Abstract
Aims & Objectives: The aim of present study to find out the effects of parity and gestational age on Anthropometric measurements of newborn in western Rajasthan, India.
Methods: The Study carried was carried out on 1019 mothers and their newborn at Umaid Hospital, Dr. Sampurnanand Medical College Jodhpur, Rajasthan. Maternal Parity included primi and multi para mothers. Gestational period included preterm, term and post term deliveries.
Anthropometric measurements of newborn included the weight, length, head, mid arm, chest, thigh, calf circumferences and skin fold thickness of neonates.
Conclusion

Keywords: Parity, gestational age, birth weight, LBW

Introduction
A baby is something you carry inside you for nine months, in your arms for three years and in your heart till the day you die

(Marry Mason)
Good maternal health and nutrition are important contributors to child survival. The lack of essential interventions to address these and other health conditions often contribute to indices of neonatal morbidity and mortality including stillbirths, neonatal deaths and other adverse clinical outcomes (Yucel O, Caroline Fall *et al*., 2009) [2].
Parity and gestationl age have been shown to increase the risk of adverse neonatal outcomes, such as intrauterine growth restriction (IUGR), prematurity, and mortality. Nulliparity may confer risk through complications during childbirth such as obstructed labor, whereas high parity has been linked to increased risk of hypertension, placenta previa, and uterine rupture. Several studies have hypothesized that in young mothers, maternal-fetal competition for nutrients and/or the mother's incomplete physical growth might contribute to adverse neonatal outcomes (Kiely *et al*, 1986; Usha, 2008, Gibbs, 2012; Shah P S, 2010; Scholl, 1992; Lee A C 2011 and Krmer 2010) [3-7, 10].

Materials and Methods
Present study was conducted at department of Anatomy, Dr. Sampurnanand Medical College Jodhpur, and Rajasthan, India. The Study carried out on 1019 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. Maternal Parity included primi and multi para mothers. Gestational period included preterm, term and post term deliveries.
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

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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 Health 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 1019 mothers just after delivered and their newborn. Observation were showing in the table number 1to 8.

Discussions & Results
Effects of Maternal Parity
Present study shows that out of 1019 mothers, 302 were primi parity and 238 were Multi parity. (Table No.1) Newborn distribution in primi parity newborn were 196(64.9%) having normal birth weight, 72(23.84%) were low birth weight, 12(3.97%) were very low birth weight, 2 (0.66%) were extremely low birth weight, 8(2.64%) still born and 12(3.97%) born with congenital anomalies (Table No.2).

Newborn distribution was in multi parity newborn there were 148(62.18%) were having normal birth weight, 57(23.94%) were low birth weight, 7(7.14%) were very low birth weight, 2 (0.84%) were extremely low birth weight, 8(8.36%) were still born and 6(2.52%) were born with congenital anomalies. (Table No.2)

Eltahir M E *et al* (2008) [10] reported that the low birth weight rate of new born of primi para mother was 12.2%, that was

nearly twice that of infants of multiparus mothers as we compared with present study it was similar.

Anthropometric measurements of primi parity male newborn were the mean (±SD) value of weight was 2.64(±0.62) kg, length was 47.56(±4.24) cm, head circumference 34.56(±3.7) cm, mid arm circumference was 10.53(±5.62) cm, chest circumference was 30.39(±4.54) cm, thigh circumference was 13.78(±3.39) cm, calf circumference was 9.23(±1.73) cm, and skin fold thickness was 3.09(±1.38) mm. While anthropometric measurements of primi parity female newborn were the mean (±SD) value of weight was 2.54(±0.58) kg, length was 46.99(±3.61) cm, head circumference was 34.1(±3.16) cm, mid arm circumference was 9.5(±1.98) cm, chest circumference was 30.1(±4.21) cm, thigh circumference was 13.81(±3.03) cm, calf circumference was 9.25(±2.65) cm, and skin fold thickness was 3.09(±1.64) mm (Table No.3).

Anthropometric measurements of multi parity male newborn were the mean (±SD) value of weight was 2.53(±0.67) kg, length was 47.17(±3.62) cm, head circumference 34.85(±9.09) cm, mid arm circumference was 9.5(±1.95) cm, chest circumference was 31.28(±11.39) cm, thigh circumference was 13.43(±2.87) cm, calf circumference was 9.09(±1.58) cm, and skin fold thickness was 2.84(±1.32) mm. While anthropometric measurements of multi female newborn were the mean (±SD) value of weight was 2.4(±0.65) kg, length was 46.26(±3.68) cm, head circumference was 33.47(±2.63) cm, mid arm circumference was 9.34(±2.09) cm, chest circumference was 30.06(±3.89) cm, thigh circumference was 13.18(±3.36) cm, calf circumference was 9.21(±3.16) cm, and skin fold thickness was 3.32(±1.28) mm (Table No.3).

On the multivariate analysis by ANOVA test, maternal parity had significant ($p<0.05$) effects on birth weight and mid arm circumference of neonates (Table No.3).

Feleke Y *et al* (2015) reported that maternal parity had significant effect only on birth weight of neonates as we compare with present study it was similar.

Wilcox MA *et al* (1996) [12] concluded that a woman is more likely to deliver a heavier baby in her second pregnancy than in her first pregnancy as we compare with present study the birth weight of first pregnancy was heavier.

Shami S A *et al*. concluded that birth order has highly significant influence to male birth weight (p>0.001) but insignificant effects on female birth weight as we compare to present study we also observed the same.

H Shajari *et al*. (2006) [13] reported that mean value of weight, length and head circumference of new born of multiparas mother was higher than newborn of primiparas mothers as we compared with present study it was similar in relation to head circumference.

Ashwaq A *et al* (2009) [14] reported in his studies that mean value of weight, length. head circumference and mid-thigh circumference was higher in new born of multiparas mothers than new born of primiparus and had mid arm circumference has significant difference, as we compared with present study the data was same.

Effects of Gestational Period
Present study shows that out of 1019 mothers, 177(17.37%) were having the pre term delivery, 795(78.01%) having term delivery and 47 (4.6%) having the post term delivery (Table No. 4).

Incidence of term deliveries were highest than pre term and post term deliveries in the present study as we compared with

other studies it was similar (Table No.6.10).

Newborn distribution in pre term deliveries were 53(29.94%) having normal birth weight, 80(45.19%) were low birth weight, 26(14.68%) were very low birth weight, 7(3.95%) were extremely low birth weight, 4(2.25%) were still born and 7(3.95%) were born with congenital anomalies (Table No. 5).

Newborn distribution in term deliveries were 573(72.16%) having normal birth weight, 162(20.4%) were low birth weight, 18(2.26%) were very low birth weight, 2(.25%) were extremely low birth weight, 20(2.5%) were still born and 18(2.26%) were born with congenital anomalies (Table No. 5).

Newborn distribution in post term newborn were 33(70.2%) having normal birth weight, 9(19%) were low birth weights, one (2.12%) were still born and 4(8.5%) were born with congenital anomalies (Table No. 5).

Anthropometric measurements of pre term male newborn were the mean (±SD) value of weight was 2.14(±0.76) kg, length was 45.3(±4.04) cm, head circumference 32.81(±2.87) cm, mid arm circumference was 9.47(±2.89) cm, chest circumference was 30.15(±12.1) cm, thigh circumference was 13.26(±3.01) cm, calf circumference was 8.62(±1.53) cm, and skin fold thickness was 2.51(±1.32) mm. While anthropometric measurements of pre term female newborn were the mean (±SD) value of weight was 1.88(±0.66) kg, length was 43.89(±3.81) cm, head circumference was 32.53(±3.11) cm, mid arm circumference was 8.43(±1.35) cm, chest circumference was 28.48(±3.31) cm, thigh circumference was 12.32(±2.34) cm, calf circumference was 8.05(±1.36) cm, and skin fold thickness was 2.24(±1.2) mm (Table No. 6).

Shah U P *et al* (2013) [15] reported that incidence of low birth weight was lower (2%) than normal birth weight (98%) in full term new born and incidence of low birth weight was higher (92%) than normal birth weight (8%) in pre term new born as we compared with present study it was similar.

Anthropometric measurements of term male newborn were the mean (±SD) value of weight was 2.69(±0.54) kg, length was 47.7(±3.65) cm, head circumference 34.8(±5.23) cm, mid arm circumference was 10.01 (±3.84) cm, chest circumference was 30.8(±7.02) cm, thigh circumference was 13.9(±3.15) cm, calf circumference was 9.19 (±1.73) cm, and skin fold thickness was 3.14 (±1.57) mm. While anthropometric measurements of term female newborn were the mean (±SD) value of weight was 2.63(±0.54) kg, length was 46.8(±3.86) cm, head circumference was 34.1(±2.86) cm, mid arm circumference was 9.71(±2.05) cm, chest circumference was 30.6(±3.86) cm, thigh circumference was 14 (±2.99) cm, calf circumference was 9.28(±2.45) cm, and skin fold thickness was 3.14(±1.36) mm (Table No. 6).

Anthropometric measurements of post term male newborn were the mean (±SD) value of weight was 2.91(±0.64) kg, length was 47.2 (±3.96) cm, head circumference 35.1(±2.76) cm, mid arm circumference was 9.95 (±1.66) cm, chest circumference was 30.4(±6.72) cm, thigh circumference was 13(±2.52) cm, calf circumference was 9.21(±1.53) cm, and skin fold thickness was 3.21 (±1.16) mm. While anthropometric measurements of post term female newborn were the mean (±SD) value of weight was 2.8(±0.48) kg, length was 48.04(±3.77) cm, head circumference was 35(±2.12) cm, mid arm circumference was 9.5(±1.78) cm, chest circumference was 31(±3.43) cm, thigh circumference was 14 (±4.11) cm, calf circumference was 9.1(±1.63) cm, and skin fold thickness was 3.3(±1.06) mm (Table No. 6).

On the multivariate analysis by ANOVA test, maternal gestational period had highly significant ($p<0.01$) effects on birth weight, length, head, mid arm, chest, thigh, calf circumference, significant ($p<0.05$) effects on length of neonates. (Table No. 6)

The mean birth weight of pre term newborn in this study was 2.01kg, in term 2.66kg and in post term 2.87kg. Hence, birth weight increase as the duration of gestation increases until 42 weeks as we compared with other studies it was similar with Shajari H and Prasad' studies and beyond 42 weeks i.e. post term, mean birth weight decreases in Lohita's study (Table No. 8).

H Shajari *et al* (2006) [13] reported that gestation age was significantly affects the mean birth weight, length and head circumference as we compared with present study it was similar.

Conclusion
Effects of Maternal Parity
- Number of primi paras mothers was higher than multi paras mothers.
- Newborn with normal birth weight and anomalies were higher in primi paras mothers than multi paras mother. Low birth weight, very low birth weight, extremely low birth weight, high birth weight still born babies were higher in newborn of multi paras mothers than primiparas.
- Mean value of weight, length and mid arm circumference were highest in male newborn of primi paras mothers and lowest in female newborn of multi paras mother. Mean value of head and chest circumference were highest in male and lowest in female newborn of multi paras mother. Thigh and calf circumference were highest in female newborn of primi paras mother and lowest in female newborn and male newborn of multi paras mother respectively. Mean value of skin fold thickness was highest in female and lowest in male newborn of multi paras mother.

Effects of Gestational Period
- Number of term deliveries was highest and post term deliveries were lowest in the present study.
- Incidence of low birth weight, very low birth weight, extremely low birth weight and still born were highest in preterm babies and lowest in post term babies. Newborns with normal birth weight were highest in term deliveries and lowest in preterm deliveries. Percentage of congenital anomalies was highest in newborns of post term deliveries and lowest in term deliveries.
- Mean value of weight was highest in male newborn of post term babies and lowest in female preterm newborn. Mean value of length was highest in male and lowest in post term female newborn. Mean value of head circumference, chest circumference, thigh circumference and skin fold thickness were highest in female post term newborn and lowest in preterm newborn. Mean value of mid arm circumference was highest in term newborn and lowest in female preterm new born. Mean value of calf circumference were highest in term and lowest in preterm female newborn.

In conclusion, this study has provided information on the effects of some of maternal characteristics on the size particularly length and head circumference of newborns which were not given emphasis on previous birth weight

studies.

It is suggested that birth weight, length and head circumference be given importance as essential indicators for monitoring and evaluating maternal and child health programs.

Table 1: Distributions of Mothers according to their Parity

S. No.	Parity	Maternal Number	Percentage
1	Primi Para Mothers	302	55.93%
2	Multi Para Mothers	238	44.07%
	Total	540	

**Note**: Primi para was included parity one and Multi para was included parity more than one.

Table 2: Effects of Parity on New Born Distribution

S. No.	Distribution of New Born	Primi Para Mothers		Multi Para Mothers	
		n	%	n	%
1	Normal	196	64.9%	148	62.18%
2	Low Birth Weight	72	23.84%	57	23.94%
3	Very Low Birth Weight	12	3.97%	17	7.14%
4	Extremely Low Birth Weight	2	0.66%	2	0.84%
5	Still Born	8	2.64%	8	8.36%
6	Incidence of Congenital Anomalies	12	3.97%	6	2.52%
	Total	302		238	

Table 3: Effects of Maternal Parity New born Anthropometry

S. No.	New Born parameters	Newborn of Primi Para Mothers		Newborns of Multi Para Mothers		Statistical Analysis (ANOVA Test)	
		Male (Mean±SD)	Female (Mean±SD)	Male (Mean±SD)	Female (Mean±SD)	F value	p value
1	Weight(kg)	2.64±0.62	2.54±0.58	2.53±0.67	2.4±0.65	3.11	**0.02***
2	Length(cm)	47.56±4.24	47±3.61	47.2±3.62	46±3.68	2.45	0.06
3	Head Circumference(cm)	34.56±3.7	34.1±3.16	34.9±9.09	33±2.63	1.41	0.23
4	Mid Arm Circumference(cm)	10.53±5.62	9.5±1.98	9.56±1.95	9.±2.09	3.40	**0.01***
5	Chest Circumference(cm)	30.39±4.54	30.1±4.21	31.3±11.39	30±3.89	0.88	0.44
6	Thigh Circumference(cm)	13.78±3.39	13.8±3.03	13.4±2.87	13±3.36	1.06	0.36
7	Calf Circumference(cm)	9.23±1.73	9.25±2.65	9.09±1.58	9.2±3.16	0.14	0.93
8	Skin Fold Thickness(cm)	3.09±1.38	3.09±1.64	2.84±1.32	3.1±1.28	1.19	0.31

Note: $p>0.05$ (Non-significant), * $p<0.05$ (Significant), ** $p<0.01$(Highly Significant)
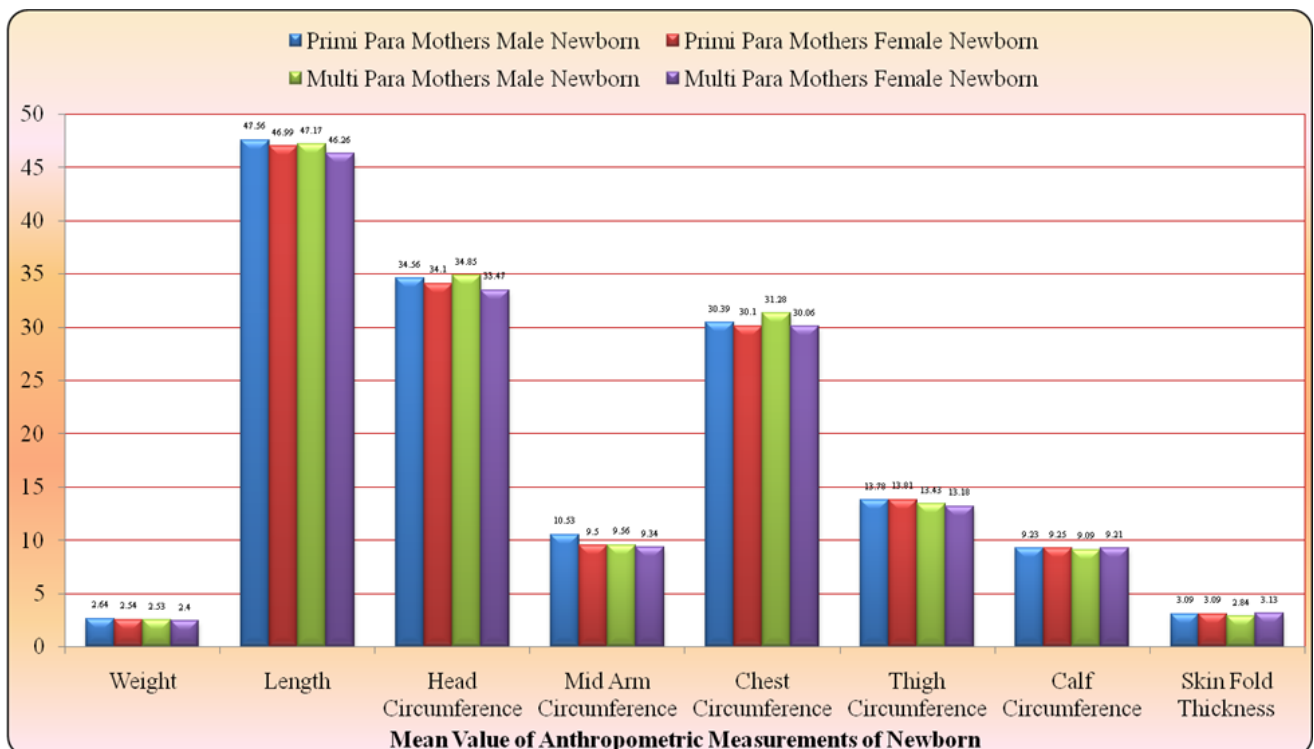
Fig 1: Showing the Effects of Parity on New Born Anthropometry

Effects of Gestational Period

Table 4: Distributions of Mothers According to Their Gestation Period

S. No.	Group	Maternal Number	Percentage
1	Mothers with Pre term Deliveries	177	17.37%
2	Mothers with Term Deliveries	795	78.01%
3	Mothers with Post Term Deliveries	47	4.61%
Total		1019	

Note: Pre term was included newborn born with gestational age less than 37 weeks

Term was included gestational age was between 37-42 weeks

Post term was included newborn born with gestational age of more than 42 weeks.

Table 5: Effects of Maternal Gestation Period on New born Distribution

S. No.	Distribution of New Born	Pre Term Newborn		Term Newborn		Post Term Newborn	
		n	%	n	%	n	%
1	Normal	53	29.94%	573	72.16%	33	70.2%
2	Low Birth Weight	80	45.19%	162	20.4%	9	19.2%
3	Very Low Birth Weight	26	14.68%	18	2.26%	0	0%
4	Extremely Low Birth Weight	7	3.95%	2	0.25%	0	0%
5	High Birth Weight	0	0%	1	0.12%	0	0%
6	Still Born	4	2.25%	20	2.51%	1	2.12%
7	Incidence of Congenital Anomalies	7	3.95%	18	2.26%	4	8.51%
	Total	177		794		47	

Table 6: Effects of Maternal Gestation Period on New Born Anthropometry

S. No.	New Born parameters	Pre term Newborns		Term Newborns		Post Term Newborns		Statistical Analysis (ANOVA Test)	
		Male Mean±SD	Female Mean±SD	Male Mean±SD	Female Mean±SD	Male Mean±SD	Female Mean±SD	F value	p value
1	Weight(kg)	2.14±0.76	1.88±0.66	2.69±0.54	2.63±0.54	2.91±0.64	2.84±0.48	57.78	0.0001**
2	Length(cm)	45.3±4.04	43.89±3.81	47.7±3.65	46.82±3.86	47.2±3.96	48.04±3.77	26.66	0.0001**
3	Head Circumference(cm)	32.81±2.87	32.53±3.11	34.8±5.23	34.1±2.86	35.1±2.76	35.39±2.12	10.80	0.0001**
4	Mid Arm Circumference(cm)	9.47±2.89	8.43±1.35	10.1±3.84	9.71±2.05	9.95±1.66	9.47±1.78	6.00	0.0005**
5	Chest Circumference(cm)	30.15±12.1	28.48±3.31	30.8±7.02	30.57±3.86	30.4±6.72	30.95±3.43	34.69	0.0001**
6	Thigh Circumference(cm)	13.26±3.01	12.32±2.34	13.9±3.15	13.96±2.99	13±2.52	14.34±4.11	6.66	0.0002**
7	Calf Circumference(cm)	8.62±1.53	8.05±1.36	9.19±1.73	9.28±2.45	9.21±1.53	9.13±1.63	9.27	0.0001**
8	Skin Fold Thickness(cm)	2.51±1.32	2.24±1.2	3.14±1.57	3.14±1.36	3.21±1.16	3.3±1.06	12.46	0.0001**

Note: p>0.05 (Non significant), * $p<0.05$ (Significant), ** $p<0.01$ (Highly Significant)
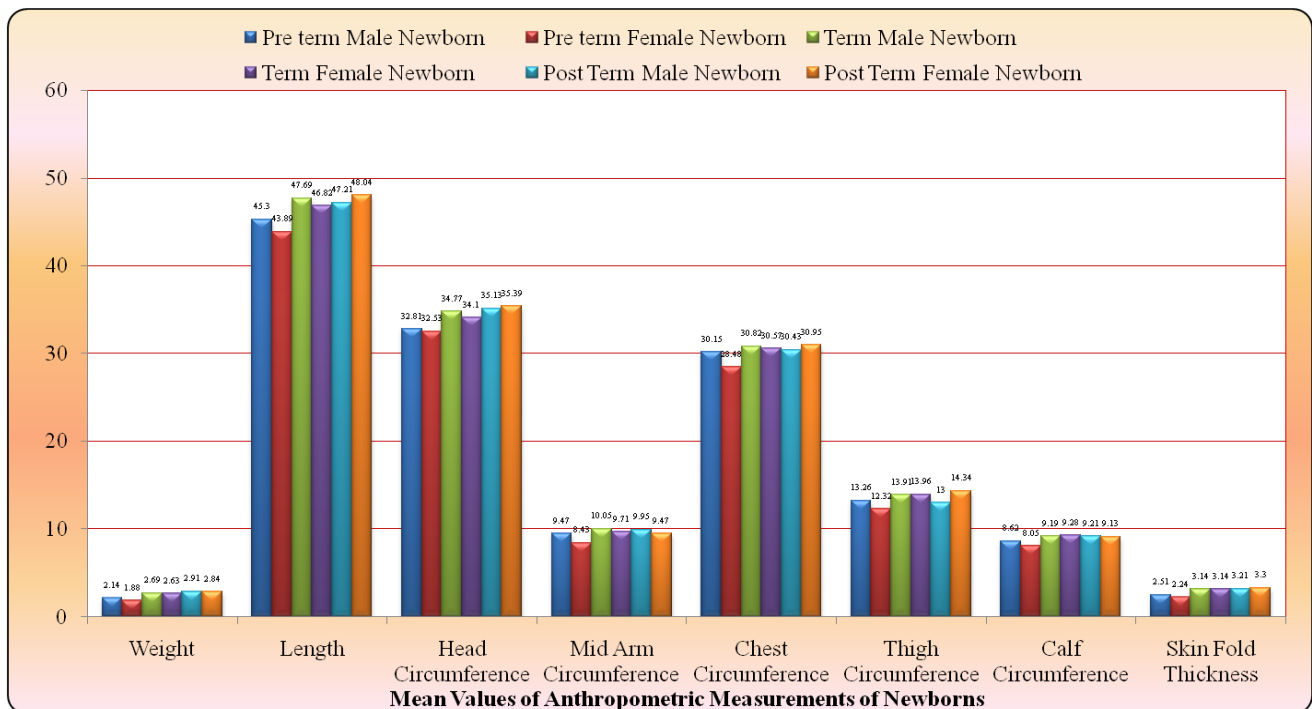
Fig 2: Showing the Effects of Gestational Period on Newborn Anthropometry.

Table 7: Comparison of Incidence of Preterm, Term and Post Term New Born in Various Studies

Studies	Pre term (%)	Term (%)	Post Term (%)
Jaya D *et al.* (1995)	3.3	96.7	0
Samiran Bi Sai (2006)	9.97	90.03	0
Lohita (2012)	15.1	83.3	1.6
Present Study(2015)	17.37	78.01	4.6

Table 8: Comparison of Mean Birth Weight of Preterm, Term and Post Term New Born in Various Studies

Studies	Pre term (kg)	Term (kg)	Post Term (kg)
Prasad KN (1994)	2.08	2.87	-
Shajari H (2006)	2.54	3.13	3.48
Lohita (2012)	2.04	2.69	2.59
Present Study(2015)	2.01	2.66	2.87

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