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Correlation of Birth Weight with other Anthropometric Parameters of Newborns in Himachal Pradesh

Soni Pankaj[1], Kapoor Kanchan[2]

[1]Department of Anatomy, Geetanjali University, Udaipur (Raj) India; [2]Department of Anatomy, Govt. Medical College, Chandigarh, U.T, India.

ABSTRACT

Introduction: Birth weight is an important indicator of child survival. Anthropometric measurements of infant body help us to predict their health and future growth. All the health personal working in child health care should be familiar with normal patterns of growth, so that they can recognize any deviations from the normal range and try to deal with the underlying disorders which could be nutritional, socioeconomic or infectious diseases.

Methods: The present study included 409 normal newborns (216 male, 193 female) delivered in labor ward of civil hospitals in Himachal Pradesh, measurements of the parameters were taken in 12-24 hours after birth, measured by using digital vernier caliper. The study was undertaken to document birth weight, crown heel length, head circumference, chest circumference and abdominal circumference of full term newborns in Himachal Pradesh.

Results: The mean and standard deviation (Mean±SD) for all the anthropometric parameters between male and females were obtained and high significant was found in birth weight (p=0.013) and head circumference (p=0.000) in Himachal Pradesh.

Conclusion: Chest circumference showed high correlation with abdominal circumference (r=0.785) in Himachal Pradesh, (r=0.752) in outer Himalayas and (r=0.848) in middle Himalayas. There is minimal but positive correlation of birth weight to all the anthropometric parameters in Himachal Pradesh.

Key Words: Himachal, Anthropometry, Newborn, Birth weight, Crown heel length, Head, Chest, Abdomen, Circumference

INTRODUCTION

Anthropometry is a series of systematized measuring techniques that expresses quantitatively the dimensions of the human body and skeleton. Newborn anthropometry is the most important as there is no such measurement for universal use because it is dependent on racial, ethnic, environmental, age factors, biological, ecological and geographic factors[1].

All health personnel having responsibility for the care of children should be sufficiently familiar with the normal patterns of growth and milestones so that they can recognize overt deviations from the normal range as early as possible, in order for underlying disorders to be identified and given appropriate attention. Growth principally implies changes in size of body as a whole or of its separate parts.

Birth weight is the most sensitive and reliable indicator of the health in a community. It is universally acknowledged that size at birth is an important indicator of foetal and neonatal health in the context of both individual and population. Birth weight in particular is strongly associated with foetal, neonatal and post-neonatal mortality and with infant and child morbidity. It is the most important determinant of children's chance of survival, healthy growth and development in future[2].

The birth size is the result of fetal growth. The fetal growth which commences shortly after conception is largely determined genetically with the modification of this genetic process by the environment[3].

Approximately four million global neonatal deaths that occur annually, 98% occur in developing countries, where most newborns die at home while they are being cared by mothers, relatives, and traditional birth attendants (dais)[4].

Species of Homo-sapiens lived an isolated life for centuries;

Corresponding Author:
Dr. Pankaj Soni, Department of Anatomy, Geetanjali University, Udaipur, Raj, India.
E-mail: drsoni13@gmail.com

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they exhibited variations from the nearby population with respect to their social, cultural, linguistic and morphological behavior. These variations between the human groups are the result of complex mixture of biological, geographical and cultural determinants. Since time immemorial, there has been the uniqueness of genetics that humans evolved which got dissolved or diluted because many isolates of these races lost their reproductive barrier[5].

In ancient times, anthropometry was used in criminology where criminals were identified by measuring parts of their body. During the early 20th century, one of its primary uses was to find out racial differences[6].

Anthropometric studies are mostly conducted with the aim to obtain the characteristics of ethnic/racial groups inhabiting a particular geographical region. These studies assist in understanding the frequency distribution of human morphologies among different races.

The geographical location, racial and environmental factors are responsible for the differences in growth and body composition in individuals. In view of this, we selected to undertake an anthropometric study of normal newborns in hills of Himachal Pradesh, which is known for its unique and uncanny socio-political and cultural tradition. Its unique composition, location, and character all makes it the bounder land[7].

The aim of the present study is to measure birth weight, crown heel length, head circumference, chest circumference and abdominal circumference of full term newborns of different zones of Himachal Pradesh and to calculate mean value, standard deviation of each zone and compare the present findings with the available literature on the same.

AIM AND OBJECTIVE

To measure anthropometrically significant parameters of full term newborn of all three zones of Himachal Pradesh. To calculate and compare mean value and standard deviation of anthropometric measurements of all three zones of Himachal Pradesh. Determine the correlation between different anthropometric parameters and compare the present findings with the available literature on the anthropometry of newborn of hilly region.

MATERIALS AND METHODS

The study was undertaken on 409 normal full term newborns comprising of 216 males (52.81%) and 193 females (47.19%) delivered in the labor ward of civil hospitals of Himachal Pradesh. All the parameters were measured in 12-24 hours after birth by using digital vernier caliper.

Ethical clearance was taken from Geetanjali University, Udaipur, Rajasthan (India). Informed consent of mother / father /guardians and permission from Director of Health Services, Shimla, Himachal Pradesh government was taken before the study.

The exclusion criteria included neonates of high risk or complicated pregnancies having medical illness such as hypertension, diabetes mellitus, infection, autoimmune disease, heart disease etc. Neonate who had caput succedaneum and cephalheamatoma and who were delivered by caesarean section showing any craniofacial deformity were also not included in the study.

Baby weight was recorded from the hospital record in the labor ward.

The crown heel length was measured in supine position with full extension of knee and distance between top of head and heel when press against a vertical surface and role on a stabilizing board.

Head circumference of neonates was calculated by placing measuring tape around the head to pass above the ears and eyebrows. It measures the occipito-frontal circumference.

The chest circumference was measured by placing flexible non- stretchable measuring tape along the point of nipples. Abdominal circumference was measured at the level of the umbilicus with a flexible non- stretchable measuring tape. The measurement was made at the end of a normal expiration (Fig. 1).

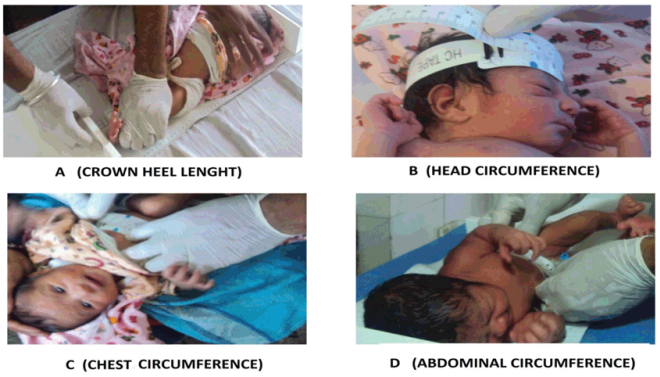

Figure 1: Showing the method of taking measurements on a newborn's baby.

The data for each newborn was recorded in a form and analyzed. For comparison of the means of the anthropometric measurements unpaired t- test was used.

OBSERVATION AND RESULTS

The present study was conducted to obtain a baseline standard criterion (Mean ±SD) of normal full term newborn's

parameters and their correlation of birth weight with other anthropometric parameters. Birth weight (p=0.013) and head circumference (p=0.000) in Himachal Pradesh showed statistically significant sex difference (p<0.05). Table 1 shows the mean and standard deviation of full term newborns in overall Himachal, outer Himalayas and middle Himalayas.

Table 1: Mean and standard deviations of full term newborns in overall Himachal, outer Himalayas, middle Himalayas.

Zone	Groups	Wt.	CHL	HC	CC	AC
Outer Himalayas	Male (120)	2.96±0.41	49.28±3.34	33.75±1.18	31.36±2.16	29.28±2.37
	Female (108)	2.85±0.41	48.94±1.91	33.19±1.20	31.35±1.92	29.67±2.23
	Both (228)	2.90±0.41	49.12±2.76	33.49±1.22	31.36±2.04	29.46±2.31
	P Value	0.044*	0.354	0.000*	0.976	0.207
Middle Himalayas	Male (96)	3.01±0.41	48.32±5.68	33.92±1.11	30.92±1.73	29.15±1.75
	Female (85)	2.96±0.42	48.06±3.57	33.48±1.06	30.64±1.66	28.89±1.63
	Both (181)	2.99±0.41	48.20±4.80	33.71±1.10	30.79±1.70	29.02±1.69
	P Value	0.423	0.711	0.007*	0.261	0.296
Overall Himachal	Male (216)	2.96±0.40	48.86±4.55	33.83±1.15	31.17±1.99	29.22±2.11
	Female (193)	2.86±0.41	48.55±2.80	33.32±1.15	31.04±1.84	29.32±2.02
	Both (409)	2.91±0.41	48.71±3.82	33.59±1.18	31.11±1.92	29.27±2.07
	P Value	0.013*	0.423	0.000*	0.499	0.623

*p<0.05 (significant) Male and Female
Wt= Birth weight (Kg), CHL= Crown Heel Length (cm), HC=Head Circumference (cm), CC= Chest Circumference (cm), AC= Abdominal Circumference (cm).

Table 2: Pearson's correlation-coefficients anthropometric parameters of newborn in Himachal Pradesh.

	Wt. (cm)	CHL (mm)	HC (mm)	CC (mm)	AC (mm)
Wt. (cm)	1	0.023	0.035	0.005	0.047
CHL (mm)		1	0.131	0.193	0.133
HC(mm)			1	0.482	0.402
CC (mm)				1	0.785
AC (mm)					1
FL (mm)					

Table 3: Pearson's correlation-coefficients Anthropometric parameters of newborn in outer Himalayas.

	Wt. (cm)	CHL (mm)	HC (mm)	CC (mm)	AC (mm)
Wt. (cm)	1	-0.039	-0.055	0.036	0.115
CHL (mm)		1	0.423	0.381	0.342
HC(mm)			1	0.550	0.466
CC (mm)				1	0.752
AC (mm)					1
FL (mm)					

Table 4: Pearson's correlation-coefficients Anthropometric parameters of newborn in Middle Himalayas.

	Wt. (cm)	CHL (mm)	HC (mm)	CC (mm)	AC (mm)
Wt. (cm)	1	0.067	0.135	-0.000	-0.033
CHL (mm)		1	0.271	0.406	0.314
HC(mm)			1	0.427	0.327
CC (mm)				1	0.848
AC (mm)					1
FL (mm)					

Wt= Birth weight (Kg), CHL= Crown Heel Length (cm), HC=Head Circumference (cm), CC= Chest Circumference (cm), AC= Abdominal Circumference (cm).

All the parameters were significantly ($p<0.001$) correlated to each other. With regards to chest circumference, abdominal circumference showed the highest correlation (r=0.785) in Himachal Pradesh, (r=752) in outer Himalayas and (r=848) in middle Himalayas as compared to other anthropometric parameters. Pearson's correlation coefficient for birth weight showed minimal correlation with all the anthropometric parameters. (Table-3, 4, 5)

The mean and SD for birth weight, crown heel length, head circumference, chest circumference and abdominal circumference of male and female described in table- 1. The mean value for male is higher than female except in abdominal circumference where females have higher value than males.

DISCUSSION

It is universally acknowledge the size at birth is an important indicator of fetal and neonatal health in the context of the both individuals and populations. Size at birth reflects two factors: duration of gestation and rate of fetal growth. It must therefore be considered with respect to gestational age; the increase in size that occurs with age will lead to severe confounding of growth and maturity[16]. India is a land of diversity and people of different province have different food habits, life style, socio-cultural trend and ethnicity. The diversity is evident in their physical structure and anthropometric parameters. It is essential to study the physical features and environment in which a particular community is living.

The existing newborn anthropometric data against which deviations from normal could be assessed are generally lacking in developing countries. In this study, measurements of newborns' anthropometric parameters are compared with the standards of other countries. But these standards have some limitations related to differences in genetic, nutritional and environmental factors.

In our study we found that the mean birth wt 2.91±0.41 which is similar to study conducted by Kataria SK and Gaur S[8], higher with Kaur et al[2], Taksande et al[9], Sunntha B and Kavita VK[12] and lower than Pachauri S and Marwah SM[11]. It was observed in this study that the difference in the mean birth weight between male and female newborn is significant ($p=0.013$).

Few studies [2, 11-13] have been done to find out a relationship between the birth weight and anthropometric parameters to predict birth weight. In this study chest circumference showed the high correlation (r=0.752) with abdominal circumference as compared to other anthropometric parameters. There is minimal but positive correlation of birth weight to all the anthropometric parameters in Himachal Pradesh. The CHL of the newborn was measured in various studies as depicted in Table 4. The value was in the range of 46-51 cm with Indian studies reporting CHL on a lower side (between 46-48 cm). If CHL is an indicator of future height of a newborn, the Indian neonates have lesser values than Turkish, Nigerian and Iranian population. However more western studies are needed to authenticate this point.

Table 5: Comparison Mean weight, head circumference, chest circumference, abdominal circumference and foot length with similar studies.

Authors	Work	Ethnic Group	Observations (Mean Values)
Kaur et al[2] (2013)	Birth weight	Faridkot, Punjab.	Wt = 2.39±5.60
	Crown heel length		CHL= 46.1±3.3
	Head Circumference		HC= 32.5±2.2
	Chest Circumference		CC = 29.2±2.6
	Abdominal Circumference		AC= ----------
Kataria SK and Gaur S[8] (2014)	Birth weight	Jodhpur, Rajasthan	Wt.= 2.92±0.39
	Crown heel length		CHL= 47.95±1.10
	Head Circumference		HC= 36.55±1.19
	Chest Circumference		CC= 31.77±1.19
	Abdominal Circumference		AC= ----------
Taksande et al[9] (2008)	Birth weight	Maharashtra, India.	Wt= 2.82±0.28
	Crown heel length		CHL= 51.15±3.31
	Head Circumference		HC= 33.52±1.92
	Chest Circumference		CC= 28.66±2.52
Anupama MP and Dakshayani KR[10] (2013)	Birth weight	Mysore	Wt= ----------
	Crown heel length		CHL= 46.60±3.36
	Head Circumference		HC= 32.60±2.59
	Chest Circumference		CC= 30.25±2.45
	Abdominal Circumference		AC= 28.34±2.45

Pachauri S and Marwah SM[11] (1971)	Birth weight	New Delhi	Wt= 2.96±4.81
	Crown heel length		CHL= 47.84±3.93
	Head Circumference		HC= 33.74±2.21
	Chest Circumference		CC= 32.58±2.65
	Abdominal Circumference		AC= ----------
Sunntha B and Kavitha VK[12] (2016)	Birth weight	Hyderabad	Wt= 2.64±0.49
	Crown heel length		CHL= 47.28±4.17
	Head Circumference		HC= 32.72±1.72
	Chest Circumference		CC=30.68±2.26
	Abdominal Circumference		AC= ----------
Present authors (2017)	Birth weight	Himachal Pradesh	Wt= 2.91±0.41
	Crown heel length		CHL= 48.71±3.82
	Head Circumference		HC= 33.58±1.17
	Chest Circumference		CC= 31.10±1.91
	Abdominal Circumference		AC=29.26±2.07

Wt= Birth weight (Kg), CHL= Crown Heel Length (cm), HC=Head Circumference (cm), CC= Chest Circumference (cm), AC= Abdominal Circumference (cm).

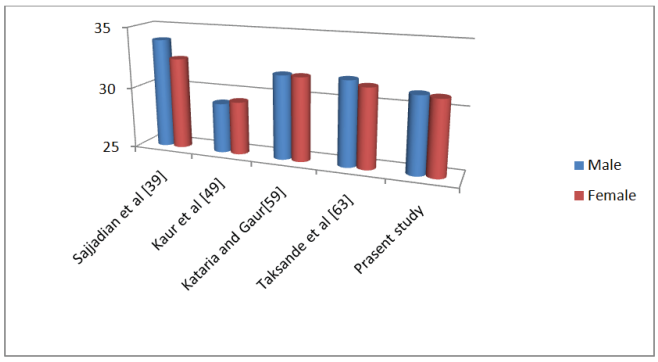

Figure 2: Comparison of chest circumference with various reported work.

Further no significant sexual difference was found in most of the studies. In addition, in the present study the difference between outer and inner Himalayas was significant; i.e. CHL decreased with the increase of altitude (Table-1).

The chest circumference was measured by various other authors and were calculated in the range of 28-34 cm in different studies Sajjadian et al[13], Shastry and Bhat[1], Pachauri and Marwah[11], Taksande et al[9], Anupama and Dakshayani[10], Kaur et al[2], Kataria and Gaur[8]. The present values were calculated as 31.1 in males and 31.0 in female neonates which are within the range. There was no significant sexual difference, also in agreement with Kaur et al[2] and Kataria and Gaur[8] (Fig-2).

The abdominal circumference came out to be 29.26 cm as per the agreement with Anupama and Dakshayani[10] (28.3). Also the authors reported significant sexual difference which could not be verified by the present worker.

Several studies have calculated the head circumference; the value fall between 32-36 cm. The present study conforms to the similar values which is 33.58±1.17 in the total number of neonates. Various authors have compared the head circumference in male and female neonates Alshemeri[3], Jaya et al[14], Taksande et al[9], Kaur et al[2] could not find any significant sexual difference; however a few other studies (Kataria and Gaur[8], Safak and Turgut[15]) have reported a statistically significant sexual difference.

The present study is in agreement with Kataria and Gaur[8] and Safak and Turgut[15] as the head circumference has the significant sexual difference in Himachal Pradesh. However the difference in outer and inner Himalayas was also compared and was not significant.

CONCLUSION

In the end it is worthwhile to write here that the available literature i.e. all India anthropometric survey points out that the length of individual in the hilly regions is comparatively less than that the plain regions. The present study is though on newborns but it also establishes the fact that as altitude increases the CHL decreases. There is clear cut difference of CHL in outer and inner Himalayas of Himachal Pradesh. The present study also arrived at comprehensive comparative findings in both the regions i.e. outer and inner Himalayas of Himachal Pradesh in terms of birth weight and head circumference. Chest circumference showed high correlation with abdominal circumference.

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Conflict of Interest: None

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