RESEARCH

Patterns of Cephalic and Facial Indices in Three Ethnic Groups in Rural Population of Banke District of Nepal

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ABSTRACT
Background:
Anthropometry, used in physical anthropometry refers to the measurement of the human individual for the purposes of understanding human variation. Anthropometry techniques aid in identification of body remains, plastic surgery, and archeology and in differentiation between people of different race and sex.

Methods:
The study was conducted in rural population of age groups 18 years and above in Banke district of Nepal. This study was conducted in normal healthy pure ethnic racial population of sample size 300 (150 male and 150 female). The measurements were taken using sliding and spreading calipers with standard anatomical landmarks.

Results:
The MHB, MHL, MFL and PI were higher in Magar males than Magar females; MFB and CI were higher in Magar females than Magar males.The CI of Magar males and Magar females was 71.22±4.00 (Dolichocephalic) and 73.11 ±11.21 (Dolichocephalic) respectively. The PI of Magar males and Magar females was 110.76 ±13.15 (Hyperleptoprosopic) and 82.92±5.18 (Euryprosopic) respectively.

Conclusion:
The human body dimensions are influenced by ecological, biological, geogra-phical, racial, gender and age-related factors. Therefore, there is still a need for further studies to know the scientific reasons behind variations in measurements among different ethnic groups in the country.

Keyword: Cephalic, Indices,Ethnic, Rural population.

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INTRODUCTION
Nepal is a multilingual, multireligious and multie-thnic country, with a population of 26 million people, belonging to over 40 different races and tribes.[1]

Nepalese society is ethnically diverse and complex in phenotype and culture ranging between Indian to Tibetan. Except for sizable population with Indian birth or ancestry concentrated in the Terai bordering India, the varied ethnic groups evolve into distinct patterns over time.[2]

Political scientists, Joshi and Rose, broadly classified the Nepalese population into three major ethnic groups in terms of their origin: Indo-Nepalese (IND), Tibeto-Nepalese (TN) and Indigenous (IN). In case of first two groups, the direction of their migration and Nepal[1] slandscapes appeared to have led to their vertical distribution. Most ethnic groups are found at particular altitudes. The first group, comprising those of Indo- Nepalese origin inhabits the more fertile lower hills, rivers, valleys and Terai plains adjoining boundary of India. The second major groups consist of communities of Tibeto-Nepalese origin occupying the higher hills from west to east. The third and much smaller groups comprise of a number of tribal communities, such as the Tharus and Dhimals of the Terai who may present the Indo-Nepalese and Tibeto-Nepalese characteristics.[2]

Banke district, a part of Bheri zone, is one of seventy-seven districts of Nepal, a landlocked country of South East Asia. The district, located in the Mid-Western Region with Nepalgunj as its district headquarter, covers an area of 2337 km[2] and population of 491,313 in 2011.[3]

The major caste/ethnic group identified by the 2011 census in the Banke district of Nepal is Muslim 18.64%, Chhetri 14.75%, Brahman-hill 6.64%, Magar 5.69%, Kami 4.71%, Yadav 4.70%, Thakuri 3.65%, Kurmi 2.22%, and other 23.02%.[3]

MATERIALS AND METHODS

The study was conducted in rural population of Banke district of Nepal following Institutional research Boards permission. The experimental protocol for cross sectional study was approved by Institutional Ethical Review Board of Nepalgunj Medical College, Chisapani, Nepalgunj. This study was conducted in normal healthy pure ethnic racial population of sample size 300 (150 male and 150 female) belonging to 18 years and above in rural population in chisapani area of Banke district of Mid-western Nepal.The data was collected from 2015-07-02 to 2016-03-12 in 3 ethnic groups Tharu (Indigenous), Kami (Indo-Nepalese) and Magar (Tibeto- Nepalese). In this study, non-probability purposive sampling technique was used for data collection for the respective ethnic races during community visits. A good rapport building was done with participants, then informed consent was taken following with questionnaire was filled up by participants. The participants were assured that anonymity would be maintained and were informed that this study was non- interventional and cross-sectional descriptive.

The sample size formula used in in this study:

❖ Sample Size (N) = $Z^2 X$ (1-P) | e^2 where Z= Z-score, P= standard deviation and e= margin of error

• **Inclusion Criteria:** Subjects of age group of 18 years and above and residents of Chisapani area of Banke district were selected.

• **Exclusion Criteria:** Subjects with any cranio-facial injury or deformity with chronic/ systemic diseases having family history of inter-caste marriage were discarded.

• **Anthropometric Measurements:** The participants were asked to sit on a chair in relaxed condition with their heads in anatomical position and the measurements were taken using a sliding caliper with standard anatomical landmarks. All the measurements were carried out after careful palpation of the head and face for anatomical landmarks and measurements were to the nearest.[4]

• **Instruments used:** Anthropometry Sliding Caliper (straight and curve). These instruments are manufactured by Syber Hegne And Company Ag, technical product division, Wiesenstrasse 8, CH-8008 Zurich, Switzerland.

• **Parameters Measured:** Maximum Head Length, Maximum Head Breadth,Face length, and Face Width in mm

• **Data Analysis** Data obtained from each subject were recorded in a special form and transferred to a computer in MS Excel software. The data collected was tabulated and analyzed using Statistical Package for Social Sciences (SPSS) -16 version software. One-way ANOVA and independent t-test were used to compare the mean among different groups. P value (0.05) was considered to see the significant differences.

1) **Maximum Head length:** It is the distance between glabella(g) to opisthocranion(op)[5]
   a. **Opisthocranion(op)-** Most prominent point on dorsal surface of head in Midsagittal plane.
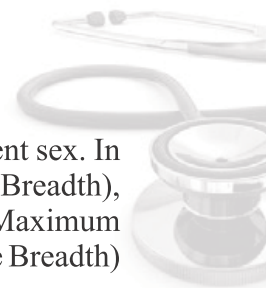
b. **Glabella-** Median eminence between two ciliary arches.

2) **Maximum Head Breadth:** It is the maximum breadth taken right angle to midsagittal plane using a spreading caliper.

3) **Cephalic Index (C.I.):** It is the ratio of maximum head breadth to maximum head length multiplied by 100.[5]

C.I = head breadth/Head Length X 100

4) **Face length:** It is the distance between nasion(n) to gnathion(gn).[6]

a. **Nasion(n):** Most anterior point midway between the frontal and nasal bones on frontonasal suture.

b. **Gnathion(gn):** Most antero-inferior point on the symphysis of the chin.

5) **Face width:** It is the distance between the Zygomatic arches.[6]

6) **Prosopic index (P.I.):** It is the ratio of face length to face width multiplied by 100[7]asdf

P.I. = Face length/ Face Width X 100

7) Depending upon indices, the types of head and face shapes were classified as given below.[7]

Table 1a: Head Shape Range of Cephalic Index (CI %)

Classification	Range
Dolichocephalic (long narrow head)	<74.9
Mesocephalic (average head shape)	75.0-79.9
Brachycephalic (broad and short head)	80.0-84.9
Hyperbrachycephalic (very broad and short head)	85.0-89.9

Table 1b: Face Shape Range of Prosopic Index (PI %)

Classification	Range
Hypereuryprosopic (very broad face)	<79.9
Euryprosopic (broad face)	80.0-84.9
Mesoprosopic (round face)	85.0-89.9
Leptoprosopic (Long face)	90.0-94.9
Hyperleptoprosopic (very long face)	>95.0

RESULTS:

Three hundred normal subjects of both sexes belonging to 3 ethnic groups: Tharu, Magar, and Kami of Banke district, Nepal without any craniofacial deformities constitutes the material for present study. In each ethnic group 100 person (50 males and 50 females) of 18 years or above were selected for study purpose. Statistical analysis was done among the 3 ethnic groups in the same sex as well as the in the different sex. In each individual MHB (Maximum Head Breadth), MHL (Maximum Head Length), MFL(Maximum Face Length) and MFB (Maximum Face Breadth) were measured.

Table 2: Mean standard Deviation and p-value of males and females of Magar population.

Parameters	Magar males (N=50) (Mean±SD)	Magar females (N=50) (Mean ±SD)	p-value
MHB (mm)	130.28±8.94	125.82±7.01	0.007 (S)
MHL (mm)	183.28±9.96	174.35±17.17	0.002 (S)
MFB (mm)	102.06±8.59	105.40±5.56	0.024 (S)
MFL (mm)	112.88±10.92	87.44±7.05	<0.001
CI	71.22±4.00	73.11±11.21	0.26 (NS)
PI	110.76±13.15	82.92±5.18	<0.001

p0.05=statistically significant difference (S); p<0.001=statistically high significant difference; p>0.05 =statistically no significant difference (NS)

Table 2 showed that there was statistically high significant difference seen in MFL and PI (P<0.001) for both males and female's population of Magars, whereas statistically significant difference in parameters of MHB, MHL, and MFB (P=0.007, 0.002 and 0.024 respectively) except CI which was not statistically significant (P=0.26).

This table also showed that MHB, MHL, MFL and PI were higher in Magar males than Magar females; on the other hand, MFB and CI were higher in Magar females than Magar males.The CI of Magar males and Magar females was 71.22±4.00 (Dolichocephalic) and 73.11 ±11.21 (Dolichocephalic) respectively. The PI of Magar males and Magar females was 110.76 ±13.15 (Hyperleptoprosopic) and 82.92±5.18 (Euryprosopic) respectively.

Table 3: Mean standard deviation and p-value of males and females of Tharu.

Parameters	Males(N=50) (Mean ±SD)	Females(N=50) (Mean± SD)	p-value
MHB (mm)	135.78±6.15	124.26±5.75	<0.001
MHL (mm)	195.92±7.82	172.34±7.54	<0.001
MFB (mm)	104.48±5.36	97.95±4.28	<0.001
MFL (mm)	90.91±7.50	84.88±4.92	<0.001
CI	69.31±2.93	72.13±2.73	<0.001
PI	87.03±6.33	86.39±4.71	0.566(NS)

p<0.05=statistically significant difference (S); p0.001=statistically high significant difference; p>0.05 =statistically no significant difference (NS)

Table 3 showed that there was statistically high significant difference seen in all the parameters except PI in between males and females of Tharu (p<0.001). This table also showed that MHB, MHL, MFL and PI were higher in Tharu males than the Tharu females except CI which was only one parameter higher in Tharu females than the Tharu males. The CI of both Tharu males and Tharu females was 72.13± 2.73 (Dolichocephalic) and 70.97 ±3.72 (Dolichocephalic) respectively, whereas PI of Tharu males and Tharu females was 86.39±4.71 (Mesoprosopic) and 103.87 ±11.00 (hyperleptoprosopic) respectively.

Table 4: Mean standard deviation and p-value of males and females of Kami population.

Parameters	Males (N=50) (Mean ±SD)	1. Females (N=50) 2. (Mean ±SD)	p-value
MHB (mm)	128.00±7.91	126.50±8.24	0.35(NS)
MHL (mm)	180.44±9.19	178.30±9.24	0.24(NS)
MFB (mm)	114.39±6.19	108.17±7.25	<0.001
MFL (mm)	103.04±5.55	113.62±9.54	<0.001
CI	71.87±4.97	70.97±3.72	0.31(NS)
PI	90.13±6.60	103.87±11.00	<0.001

p<0.05=statistically significant difference (S); p<0.001=statistically high significant difference; p>0.05 =statistically no significant difference (NS)

Table4 showed that there was statistically high significant difference seen in MFB, MFL and PI (p<0.001) in both sex of Kami males and females whereas MHB, MHL and CI showed statistically no significant difference.

The MHB, MHL, MFB and CI higher in Kami males than Kami females whereas MFL and PI higher in the Kami females than the Kami males. The CI of Kami males and females was 71.87± 4.97 (Dolichocephalic) and 70.97±3.72 (Dolichocephalic) respectively; the PI was 90.13±6.60 (Leptoprosopic) and 103.87±11.00 (Hyperleptoprosopic) in Kami males and females respectively.

Comparing multiple parameters between Magar males and Tharu males the results found were as follows:

When Magar males were compared with Tharu males it was found to have statistically high significant difference in MHL, MFL and PI (p<0.001); statistically significant for MHB and CI (p=0.001 and 0.008) respectively; no statistically significant difference was observed for MFB (p=0.09).The MHB, MHL and MFB were found higher for Tharu males than Magar males, whereas MFL, CI and PI were lower in Tharu male than the Magarmales.The CI of Magar males and Tharu males was 71.22±4.00 (Dolichocephalic) and 69.31±2.93 (Dolichocephalic) respectively; the PI was 100.76±13.15 (Hyperleptoprosopic) and 87.03±6.33 (Mesoprosopic) for Magar males and Tharu males respectively.

Comparing multiple parameters between Magar males and Kami males, the following results were found:

When Magar males compared with Kami males it was found to have statistically high significant difference in parameters of MFB, MFL and PI (p<0.001) and statistically no significant difference was observed in parameters of MHB, MHL and CI (p=0.18, p=0.14 and p =0.47 respectively). The MHB, MHL, MFLand PI was found higher for Magar males than Kami males, whereas MFB and CI was higher for the Kami males than the Magar males. The CI of the Magar males and the Kami males was 71.22±40 (Dolichocephalic) and 71.87±4.97 (Dolichocephalic) respectively; the PI of the Magar males and the Kami males was 110.76±13.15 (Hyperleptoprosopic) and 90.13±6.60 (Leptoprosopic) respectively.

Comparing multiple parameters between Tharu males and Kami males, the following results were found:

It was found to have statistically high significant difference in parameters of MHB, MHL, MFB and MHL (p<0.001) and statistically significant difference for CI (p=0.02) and PI (p=o.01). The MHB, MHL was found to have higher for Tharu males than Kami males. On the other hand, MFB, MFL, CI and PI were less than the Kami males.The CI of the Tharu males and the Kami males was 69.31±2.93 (Dolichocephalic) and 71.87±4.97 (Dolichocephalic) respectively;

whereas the PI was 87.03±6.33 (Mesoprosopic) and 90.13±6.60 (Leptoprosopic) respectively.

DISCUSSION

Studies have suggested that race as well as sex can be determined accurately with head measure-ments, which varies between major races and even smaller ethnic groups. Susane et al[8]in their studies found significant genetic variance component for maximum head length and breadth in both sexes. Anthropological studies conducted by Golalipour et al[9] and chamella et al[10], based on racial changes, have revealed that people from Africa, India, Australia, Central part of Europe and North America are Dolichocephalic; head shapes of people in the Pacific Ocean are Brachycephalic, while in the Middle East, Russia and Central part of Europe the head shapes are Mesocephalic and most people living along the border of the Atlantic Ocean are of the Mesocephalic type.

When the MHB and the MHL were compared between two different ethnic groups in the same sex i.e. the Magar males with the Tharu males it showed significant difference (p<0.05) in MHB, and highly significant difference (p<0.001) in MHL. In the other hand, when Tharu males compared with Kami males it showed highly significant difference (p<0.001) in both MHB and MHL. But it showed no significant difference (p>0.05) when the Magar males compared with the Kami males. The MHB and the MHL were shortest in Tharu females.

The present study showed that Tharu (males) population had largest head length and breadth following by Magar (males) and Kami (Males). But cephalic index was similar in all 3 ethnic groups in males as well as females. This study also showed that Tharu (females) population had least head length and head breadth.

The cephalic index of the 3 ethnic groups was less than 74.9, which was classified as Dolicho-cephalic. The cephalic indices obtained in this study were lower than those of other studies such as study by Golalipour[11] in 2006 in Iran, by Rajlaxmi et al[12] in India and Jordon[13] in South Africa in 1976 which was 84.8±6.9, 88.4±1.1 and 80.29 respectively.

In the study conducted in 1986, Singal[14] found dolichocephalic head in Jat-Sikh females which were significantly larger than Bania females. Krogmanet al[15] suggested that only skull may be of value in estimating the race. Singh[16] has concluded that Mangloid populations are Brachycephalic which ranges from 81-85.5.

The mean PI of the male of the Magar, Tharu, and Kami was (110.76±13.15, 87.03±6.33, and 90.13±6.60) respectively; which were catego-rized as hyperleptoprosopic, Mesoprosopic, and Leptoprosopic respectively. The mean PI of the females of the Magar, Tharu, and Kami was (82.92±5.18, 86.39±4.71, and 103.87±11.00) respectively, which were categorized as Eurypro-sopic, Mesoprosopic, and Hyperletoproscopic. The MFB and the MFL were found to be highest in the same population i.e. Kami males and Kami females respectively. However, the MFB and the MFL were found to be shortest in case of Tharu females.

The MFB, MFL and PI were found to be highly significant (p<0.001) when the Magar males compared with the Kami males, and the Tharu males compared with the Kami males. When the Magar males were compared with the Tharu males; MFL and PI were highly significant but, the MFB was not significant.

Zhuang and Bradmiller in Chinese population reported that Face length in male is slightly shorter in comparison to American subjects (p<0.05).[17]Lilli et al[18] in 2008 found significant differences in Face breadth of Chinese males and females which were larger than American males and females, the present study showed that Kami (Indo-Nepalese) population had longer face breadth followed by Magar females (Tibeto-Nepalese) and Tharu males and Magar males. The MFB was shortest in the Tharu females.

The mean PI (110.76±13.15) found to be highest in Magar males, in other hand, the mean PI (82.92±5.18) found to be shortest in Magar females.

The results of this study are in agreement with results from other regions of the world where the Mesoprosopic and Euryprosopic types were found to be the dominant type in Turkman newborns and native Fars newborns respectively

as conducted by Golalipour et al[19] in 2005. In this study, Magar males and Magar females were found to be Hyperleptoprosopic and Eury-prosopic respectively; Tharu males and Tharu females were found to be Mesoprosopic and Hyperleptoprosopic respectively; Kami males and Kami females were Leptoprosopic and Hyperleptoprosopic respectively.

CONCLUSION

The study carried among the people in Mid-Western Nepal are found to have a long face (Leptoprosopic), compared to other population. The study on the face shape in this part of Nepal indicates that ethnicity and geography affect the form of any individual's face.MHL, MHB, MFB, MFL, CI and PI among Magar, Tharu and Kami of Banke district of age group 18 or above have revealed significant differences in all measured anthropometric parameters.Thus, it can be concluded that Magar (Tibeto-Nepalese) presents with long and narrow head (Dolicocephalic) while, Magar males with very long face (Hyperleptoprosopic) and Magar females with broad face (Euryprosopic). Similarly, Tharu (Indigenous) presents with Dolicocephalic head and round face (Mesoprosopic) in males and very long face (Hyperleptoprosopic)in females. In the other hand, Kami (Indo-Nepalese) have long face (Leptoprosopic) in both male and females with Dolicocephalic head.

The results showed ethnic and sexual variations in all parameters indicating the influence of ethnicity and sex on craniofacial anthropometry. It can be concluded that there may be the role of races in the variation of above parameters because the human body dimensions are influenced by ecology, geography and race. Therefore, there is still a need for further studies to know the scientific reasons behind variations in measurements among different ethnic groups in this country.

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