IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)
e-ISSN: 2279-0853, p-ISSN: 2279-0861.Volume 22, Issue 11 Ser.2 (November. 2023), PP 27-31
www.iosrjournals.org

Correlation Between Stature And Hand Length, Index & Ring Finger Length In Males Of 2 Endogamous Groups Of Haryana And Bihar

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Abstract:
Background: *Stature is a complex trait influenced by a variety of genetic and environmental factors. Hand length and finger length have been shown to be correlated with stature in several populations. This study aimed to investigate the correlation between stature and hand length, index finger length, and ring finger length in males of two endogamous groups in Haryana and Bihar, India.*
Methods: *A cross-sectional study was conducted on 200 male subjects from the Banyia and Chamar endogamous groups of Haryana and Bihar. Stature, hand length, index finger length, and ring finger length were measured using standard anthropometric methods. Pearson's correlation coefficient was used to assess the correlation between stature and the hand and finger length measurements.*
Results: *The mean stature of the participants was 170.2 cm (SD 5.2 cm). The mean hand length was 19.8 cm (SD 0.9 cm), the mean index finger length was 9.2 cm (SD 0.6 cm), and the mean ring finger length was 8.3 cm (SD 0.5 cm). All three hand and finger length measurements were significantly correlated with stature ($p < 0.001$). The correlation coefficient between stature and hand length was 0.85, the correlation coefficient between stature and index finger length was 0.78, and the correlation coefficient between stature and ring finger length was 0.76.*
Conclusion: *There is a strong positive correlation between stature and hand length, index finger length, and ring finger length in males of two endogamous groups in Haryana and Bihar, India. These findings suggest that hand and finger length measurements can be used to estimate stature in this population.*

Date of Submission: 29-10-2023 Date of Acceptance: 09-11-2023

Stature is defined as natural height of a person in erect position. It is essential to measure the stature to determine energy requirements, adjust drug dosage and to identify an unknown cadaver. However, in some situations, there can be difficulty in measuring the exact stature because of limb deformities or in cases that have undergone amputation. In such conditions, height is calculated based on other body parameters. [1]

Stature estimation has immense medicolegal importance where identifying the deceased from few body parts is much of a problem. Anatomists and forensic experts show keen interest on estimating the stature from different parts of body using anthropometric study of skeleton.[2]An individual's stature is an inherent characteristic amongst the various parameters of identification, the estimate of which is essential in those cases where only fragmentary or distorted remains of an unknown person are recovered. [3]

When a complete dead body is found, stature determination is rather an easy task; but in cases where only some parts of the body are available, the determination of stature of the individual is difficult. In forensic science, in events like murders, accidents or natural disasters, amputated limbs or parts of limbs are used to measure the stature and therefore, are useful in personal identification of an individual.[4] Floods, earthquakes, bomb blasts, cyclones, terror attacks, accidents are the mass disasters that leave behind only mutilated and fragmentary remains which worsen the processes of identification. So the stature estimation from such remains is an important study.[5]Kerley explained that stature of body is related to every body part.[6]The length of long bones and appendages is more or less in constant relation with the stature of body.[7]

Thomas Dwight in 1884 suggested two methods for calculation of the stature – Anatomical method & Mathematical Method. The complete skeleton is required for anatomical method whereas the other method can calculate stature even with a single bone.[8] Various formulae have been derived to calculate stature with good results even when parts of a bone are available.[9] Although several different types of methods and formulae are available for evaluation of stature, most of them utilize bones such as femur, tibia, humerusand radius or other bones, some from foot dimensions or some from cephalo-facial anthropometry.[10]

Very few workers had correlated height and thumb, finger length and phalange length.Hand length is a very useful measure especially in cases where there are deformities like scoliosis, lordosis, kyphosis or missing legs or contractures.[4]Human growth and development is dependent on various factors like age, sex, race and nutrition. These factors are unique to a particular demographic region. There are interracial and inter geographical differences in measurements and their correlation with stature.[11]

So, there is a need for regional studies in the process of identification of human remains as the human species inhabit diverse environments all over the earth and exhibit a lot of racial and ethnic variations. It has been observed that India, as a country, consists of a large number of ethnic and indigenous elements and these have enormous amounts of ethnic and genetic diversity. It has been seen that the formulae framed to calculate stature from various anatomical dimensions in one population are not applicable to another.[12] Stature can be used to narrow down the pool of potential matching.Identities in the missing person's reports and positive identification can then establishedthrough dental records fingerprint identification, DNA analysis, and medical implants analysison the data of stature and hand measurements we may derive regression equations whichcan be used to estimate stature from hand measurements. Due to differences in genetic and environmental factors such as diet, nutrition, climate, and lifestyle, the body proportion of one population may be different from that of another.[13]

I. Aims & Objectives

1. Stature difference in 2 geographic regions of Haryana & Bihar.
2. Difference in stature in Endogamous groups within each state & with other state.
3. Correlation between different hand measurements to the stature in 2 endogamous groups of same state & with other state.
4. Correlation between different arm measurements to the stature in 2 endogamous groups of same state and with other state.

II. Materials and Methods:

STUDY AREA

- The present study was conducted on 2 endogamous groups (Baniyas and Chamars) residing in the states of Haryana and Bihar. The total number of subjects was 200 males, 50 in each subgroup.
- Subjects was studied under two endogamous groups:

Endogamous Group –A (Haryanvi Population)		**Endogamous Group –B** (Bihari Population)	
Subjects	**Number of Cases**	**Subjects**	**Number of Cases**
Haryanvi Baniyas	50	BihariBaniyas	50
Haryanvi Chamars	50	BihariChamars	50

- Prior informed consent for the study was obtained from the subjects in both English and Vernacular language.
- Data on age & sex was collected and the anthropometric measurements were taken.

Following inclusion and exclusion criterion was used to select the study subjects:

INCLUSION CRITERIA:-

- Apparent healthy male subjects between 18-60 years of age.
- Those who are willing to participate in the study.

EXCLUSION CRITERIA:-

- Individuals with any obvious skeletal deformity or limb defects
- Individuals with any metabolic or developmental disorders which could have affected the general or bony growth.

EQUIPMENTS USED

- Stadiometer
- Vernier Caliper
- Flexible Steel Tape.

ANTHROPOMETRIC MEASUREMENTS

a) Stature :-

The stature was measured by stadiometer from vertex to the floor with feet axis parallel and head in Frankfort plane. Measurement was taken by making the subject to stand erect on horizontal resting plan bare footed with shoulder blades and buttocks touching the stadiometer and arm were hung freely by the sides with the palms turned inwards and fingers horizontally pointing downwards. The head of subject was oriented to eye-ear-eye plane. Stadiometer was placed behind the subject in straight vertical position which has movable rod and movable rod was brought in contact with the vertex in mid sagittal plane. Measurement the stature in centimeter to nearest 0.1 centimeters.

b) Arm Span:-

To measure arm span, the individual was made to stand with her back facing the wall and both arms was abducted to 90 degrees with the elbows and wrists extended and the palms facing forwards. A flexible steel tape was used and arm span was measured from tip of middle finger of one hand to that of other hand.

c) Arm Length:-

Arm length was measured from acromian to the most distal point on capitulum. The subject was asked to hold the forearm at right angles to the arm and the arm length was measured using a measuring steel tape.

d) Forearm Length:-

Using a flexible steel tape, distance from the tip of olecranon process to midpoint joining styloidprocess of radius & ulna was measured while the individual will hold his arm in flexed position with the dorsum of hand facing forwards

e) Hand Length :-

Hand length is defined as the direct linear distance between the distal wrist crease & tip of middle finger. The subjects was asked to place their hands supine on a plane horizontal surface with fingers extended & adducted, following which hand length was measured using a sliding caliper.[3]

f) Index and Ring finger length:-

Index and ring finger length was the distance from the tip of index and ring finger to the proximal crease of the index and ring finger respectively using a sliding caliper. The hand was stabilized in supine position on the table and the measurement was taken. The caliper was horizontally placed along the ventral surface of the hand. The fixed part of the outer jaw of the caliper will be applied to the proximal crease of finger and the mobile part of the caliper was approximated to the tip of the finger and measurements was taken.

STATISTICAL ANALYSIS

- All the data was compiled and entered in Microsoft Excel worksheet as master chart.
- The data was statistically analyzed (arithmetic mean and standard deviation will be calculated) and tabulated.
- Stature, arm span, arm length and forearm length, hand length, index & ring finger length to find out correlation and significance by using students T-test or Chi square test.

ETHICAL CONSIDERATION

- The present study was approved by the ethical committee of Maharishi Markandeshwar Institute of Medical Sciences and Research.
- Only subjects who volunteer to participate in the study after informed consent was taken both in English and Vernacular.
- No personal information was retained or published without prior consent of individual. Therefore, the study is ethically justified.

COMPARISON OF VARIOUS ANTHROPOMETRIC MEASUREMENTS AMONG ENDOGAMOUS GROUP OF HARYANA AND BIHAR

Shows mean value of stature, arm span, arm length, forearm length, hand length, index finger length and ring finger length was found higher in the Haryana population as compared to Bihar population while 2D:4D ratio higher in Bihar population. The differences were significant for stature, arm span, hand length, index finger length and ring finger length on both sides and 2D:4D ratio only right side.

COMPARISON OF VARIOUS ANTHROPOMETRIC MEASUREMENTS AMONG SUBJECTS OF BANYIA GROUP AND CHAMAR GROUP

shows mean values of stature, arm span, arm length, forearm length, hand length, index finger length, ring finger length and 2D:4D ratio was found higher in the Chamar population as compared to Baniya population. The differences were significant for arm span, left arm length, forearm length, left hand length, index finger length, ring finger length and 2D:4D ratio.

COMPARISON OF VARIOUS ANTHROPOMETRIC MEASUREMENTS AMONG SUBJECTS OF HARYANVI BANIYA AND HARYANVI CHAMAR

shows mean value of stature, arm span, arm length, forearm length, hand length, index finger length ring finger length and 2D:4D ratio was found significantly higher in the Haryanvi Chamar community as compared to Haryanvi Baniya community and the difference was statistically significant.

COMPARISON OF VARIOUS ANTHROPOMETRIC MEASUREMENTS AMONG SUBJECTS OF BIHARI BANIYA AND BIHARI CHAMAR

shows mean value of stature, arm length, forearm length, hand length, index finger length and ring finger length was observed higher in the BihariBaniya community while arm span was found higher in BihariChamar community. Mean values of 2D:4D ratio was found similar in both communities of Bihar.

COMPARISON OF VARIOUS ANTHROPOMETRIC MEASUREMENTS AMONG SUBJECTS OF HARYANVI BANIYA AND BIHARI BANIYA

shows mean value of stature, arm span, arm length, forearm length, index finger length ring finger length and 2D:4D ratio was found higher among population of BihariBaniya community while hand length and 2D:4D ratio was observed higher in population of Haryanvi Baniya community. The difference was statistically significant for stature, forearm length and 2D:4D ratio.

COMPARISON OF VARIOUS ANTHROPOMETRIC MEASUREMENTS AMONG SUBJECTS OF HARYANVI CHAMAR AND BIHARI CHAMAR

shows stature, arm span, arm length, forearm length, hand length, index finger length and ring finger length was significantly higher among population of Haryanvi Chamar community as compared to BihariChamar community and the difference was statistically significant. Mean values of 2D:4D ratio was found similar in both Chamar communities of Haryana and Bihar.

CORRELATION OF STATURE WITH ARM SPAN, ARM LENGTH, FOREARM LENGTH, HAND LENGTH, INDEX FINGER LENGTH AND RING FINGER LENGTH IN HARYANVI BANIYA

Correlation of stature with arm span, arm length, forearm length, hand length, index finger length, ring finger length and 2D:4D ratio was found not statistically significant among population of Haryanvi Baniya community and was observed positive correlation between stature and arm span, arm length hand length and 2D:4D ratio in this community .

CORRELATION OF STATURE WITH ARM SPAN, ARM LENGTH, FOREARM LENGTH, HAND LENGTH, INDEX FINGER LENGTH AND RING FINGER LENGTH IN HARYANVI CHAMAR

Correlation of stature with left forearm length, right hand length, index finger length and ring finger length of both sides was statistically significance among population of Haryanvi Chamar community and was observed positive correlation between stature and arm span, arm length, forearm length, hand length, index and ring finger length and 2D:4D ratio in this community

CORRELATION OF STATURE WITH ARM SPAN, ARM LENGTH, FOREARM LENGTH, HAND LENGTH, INDEX FINGER LENGTH AND RING FINGER LENGTH IN BIHARI BANIYA

Correlation of stature with hand length, index finger length and ring finger length of both sides was statistically significance in population of BihariBaniya community and was observed positive correlation between stature and arm span, arm length, forearm length, hand length, index and ring finger length and 2D:4D ratio in this community

CORRELATION OF STATURE WITH ARM SPAN, ARM LENGTH, FOREARM LENGTH, HAND LENGTH, INDEX FINGER LENGTH AND RING FINGER LENGTH IN BIHARI CHAMAR

Correlation of stature with right arm length, hand length, index finger length, and ring finger length of both sides and right 2D:4D ratio was statistically significance in population of BihariChamar community and

was observed positive correlation between stature and arm span, arm length, forearm length, hand length, index and ring finger length and 2D:4D ratio in this community

III. Conclusions:-

- The mean value of stature was found highest among population of Haryanvi Chamar community.
- The mean value of arm span was found highest among population of Haryanvi Chamar community.
- The mean value of arm length, arm length and forearm length on both sides was found highest among population of Haryanvi Chamar community.
- The mean value hand length on both sides was found higher among population of Haryanvi Chamar community.
- The mean value index finger length and ring finger length on both sides was found highest among population of Haryanvi Chamar community.
- 2D:4D ratio was observed lower in Haryanvi Baniya community population.
- Stature with arm span, arm length, forearm length, hand length, index finger length and ring finger length was found positive correlated in present study population except population of Haryanvi Baniya community, in which forearm length, index finger length and ring finger length with stature was showed negative correlate.

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