Stature Estimation and Formulation of Regression Equation from Ear Anthropometry in Haryanvi Population

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Abstract

Background: Human beings are unique in number of physical characteristics like shape and form of an individual. These characteristics are influenced by a wide range of racial, ecological, psychological, geographical, gender and biological variations. Human external ear is often overlooked during anthropometric measurements. The structure of human ear is so much variable that even two ears are different in same individual and it also varies according to age, sex, race and ethnic group.Authentic anthropometric data of ear for a particular population is necessary for designing of ear products for occupational environments, to find out the age, sex and stature of an individual in that population. This data on ear measurements can also be helpful in forensic and medico-legal cases for personal identification of an individual. The main objective of the study is to find any relationship between ear parameters and stature and also to formulate regression equation for estimation of stature in Haryanvi adult Jaats.

Methods: The present study was conducted on 300 healthy Haryanvi Jaats (150 females and 150 males) aged 20 to 60 years. Measurements of ear length, ear breadth and stature were taken on each subject.

Conclusion: Ear length and ear breadth are not significantly correlated with stature ($p > 0.05$) in both the sexes except ear breadth which is significantly correlated with stature in males ($p < 0.05$).

The present study concluded that stature cannot be estimated from ear length and ear breadth in Haryanvi population.

Key words: *Anthropometry, Measurements, Parameters, Stature.*

Introduction

Human beings are unique in number of physical characteristics like shape and form of an individual. These characteristics are influenced by a wide range of racial, ecological, psychological, geographical, gender and biological variations. Human external ear is often overlooked during anthropometric measurements. Anthropometric landmarks are described to measure the dimensions of external ear[1]. People often feel embarrassed and depressed who have abnormal structure of ears that may be due to accidental or natural. To rectify the auricular defects like missing parts or inappropriate size, surgery is needed. For that, the data regarding bilateral position on face and normal auricular dimension in different ethnic groups is required. The structure of human ear is so much variable that even two ears are different in same individual and it also varies according to age, sex, race and ethnic group[2]. Authentic anthropometric data of ear for a particular

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population is necessary for designing of ear products for occupational environments, to find out the age, sex and stature of an individual in that population[3]. This data on ear measurements can also be helpful in forensic and medico-legal cases for personal identification of an individual. Stature prediction is required in people whose height cannot be measured due to neuromuscular disorders, lower limb or spinal deformity[4]. For them it can be measured through anthropometry. For estimation of stature various body dimensions like arm span, hand and foot length and different cranio-facial parameters are used because they exist a definite biological relationship with stature[5]. Agnihotri et al[6] did not find any significant relationship between stature and ear parameters but Laxman K[7] and Abdelaleem & Abdelbaky[8] etc reported a significant relationship. Very few studies are there to estimate the stature from ear parameters. so, the present study attempted to find any relationship between ear parameters and to formulate regression equation for estimation of stature.

Material and Method

The present study was a community based anthropometric study conducted on 300 healthy Haryanvi Jaats (150 females and 150 males) of age group 20 to 60 years. Purposive sampling method was used to collect the samples. The purpose of the study was explained and consent from all the subjects were taken.

Along with stature, ear length and ear breadth were measured from healthy Haryanvi jaats without any craniofacial deformity by anthropometric rod and sliding caliper. The measurements were taken according to the landmarks and procedure recommended by Nath S[9] and Krishan & Kumar[10]. The taken anthropometric measurements are described as: -

5.   Stature (S): It is the vertical distance between the plane (where the subject stands barefooted) and the highest point on the vertex on the head. For measurement of stature, the subject was asked to stand straight upright on horizontal surface with arms hanging at sides and shoulders relaxed. The subject's head was kept in Frankfurt Horizontal Plane and shoulder blades, buttocks and heels touching the measurement surface.

6.   Ear length (EL): The straight distance between the superaurale (sa) and subaurale (sba).

7.   Ear breadth (EB): The straight distance between the two most lateral points of the ear. One lies at the base of the ear and other lies at the helix.

Statistical analysis like mean, standard deviation using Z-test, Karl Pearson's correlation coefficient and derivation of regression equation using Statistical Package for Social Sciences (SPSS) was done.

Results and Discussion

Table 1 shows the descriptive statistics i.e mean, standard deviations, minimum and maximum values for ear length, ear breadth and stature measurements in adult Haryanvi males and females respectively. All the parameters are higher in males than females.

Table 1: Descriptive Statistics for Ear Length, Ear Breadth and Stature in Adult Haryanvi Jaats (N = 300)

Measurements in (cm)	Gender	Mean	S.D	Minimum	Maximum
Ear Length	Male	6.54	0.484	5.63	7.96
	Female	6.26	0.425	5.36	7.56
Ear Breadth	Male	3.41	0.248	2.76	4.16
	Female	3.26	0.316	2.66	5.26
Stature	Male	172.14	6.547	151.40	192.00
	Female	156.07	6.061	141.46	177.00

Table 2 shows that ear length and ear breadth are not significantly correlated with stature (p>0.05) in both the sexes except ear breadth which is significantly correlated with stature in males (p<0.05).

Table 2: Pearson Correlation Coefficients between stature and ear measurements

Measurements	Gender	Pearson Correlation Coefficient (r)	p-value
Ear Length	Male	-0.001	0.99
	Female	0.221	0.44
Ear Breadth	Male	0.194	0.01*
	Female	0.063	0.49

*Significant (p<0.05)

Table 3 shows the regression equations to calculate stature from cephalic measurements i.e. from ear length (EL), ear breadth (EB) by substituting the values of cephalic measurements.

Table 3: Regression equations for estimation of stature from ear measurements

Regression Equation		Standard Error of Estimate (SEE)	
Males	Females	Males	Females
Height = 172.23+(-0.14) EL	Height = 136.31+ 3.154 (EL)	6.56	5.93
Height = 154.68+ 5.114(EB)	Height = 152.10+1.214 (EB)	6.44	6.06

Table 4 shows thecomparison of results of present study with similar available studies on different populations which states that mean values of ear length and ear breadth are higher in males as compared to females. The value of ear length and ear breadth is different in all studies that reveals that these parameters vary in different populations.

Table 4. Studies showing comparison of Mean Ear Length and Mean Ear Breadth of present study with the mean of previous studies.

Sr. No.	Authors	Study Population	Mean Ear Length		Mean Ear Breadth	
			Males	Females	Males	Females
9.	Present study	Haryanvi Jaat Population	6.51	6.26	3.45	3.26
10.	Japatti SR el al13	Maharashtrian Population	6.54	6.26	3.41	3.26

***Cont...* Table 4. Studies showing comparison of Mean Ear Length and Mean Ear Breadth of present study with the mean of previous studies.**

11.	Ekemini & Ekanem11	Nigerian Population	5.89	5.65	3.51	3.35
12.	Gupta & Ambekar14	Nepalese Population	6.13	5.72	3.14	3.03
13.	Laxmi el al15	Northern Indian Population	6.20	5.73	3.42	3.20
14.	Acar el al16	African Population	5.83	5.58	3.35	2.86
15.	Sharma N17	Northern Indian Population	5.43	5.49	2.89	2.81
16.	Verma et al18	North- East Indian Population	6.15	5.75	3.14	2.94
17.	Verma et al18	North- West Indian Population	6.37	5.89	3.23	2.91
18.	Mustapha el al19	North-Western Nigerian Population	5.48	5.49	2.80	2.72
19.	Taura MG et al12	Nigerian Population	6.03	5.95	3.04	2.95
20.	Agnihotri et al6	Indo-Mauritius Population	6.17	5.69	3.36	3.06

In the present study, ear length and ear breadth are not significantly correlated with stature (p>0.05) in both the sexes except ear breadth which is significantly correlated with stature in males (p<0.05). Agnihotri et al[6] also finds that ear breadth is not significantly correlated with stature in Indo-Mauritius population but ear length is found to be significant. The other studies done by Laxman K[7], Abdelaleem & Abdelbaky[8], Ekemini & Ekanem[11] and Taura MG et al[12] shows that there is significant correlation between the stature and ear parameters of different population (p<0.05).

Conclusion

The present study concluded that stature cannot be estimated from ear length and ear breadth in Haryanvi population as these parameters are not significantly correlated with stature (p>0.05).Further it is believed that large sample size should be examined to validate the findings of this study and to make a definite conclusion.

Conflict of Interest - Nil

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