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Research Article

A CORRELATIVE SURVEY STUDY ON GREEVA PRAMANA (NECK LENGTH) AND HEIGHT OF THE INDIVIDUALS

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ABSTRACT

Pramana Shareera is physical Anthropometry as described in Ayurveda used for physical measurement for assessing height, length, weight, age, race and nationality. The anthropometric measurement of various parts of the body is usually proportional to the height of an individual. The disproportion in physical measurement of various parts with respect to height of an individual is not desirable. Any changes in body dimension influence the overall health and wellbeing of individuals and population. The purpose of this study is to analyze anthropometric relationship between length of the Greeva (Neck) and Height of the individuals. An Observational survey carried out in 400 apparently healthy individuals of age group 25-40 years, irrespective of gender, religion and socioeconomic status was selected randomly from Suburban area of Hassan. Informed consent from volunteers was taken and measurement was recorded by fixing the anatomical points as standard. A positive correlation between Greeva Pramana and Height of an individual was observed and it was statistically significant (P-Value is < 0.005). A moderate correlation was found between Greeva Pramana and height of the individuals. In men, overall body height and neck length were found higher when compared to that of women. In addition, it was possible to formulate Regression equations for height estimation by using Greeva Pramana. The Greeva Pramana provides an accurate and reliable means in estimating height of an individual. The regression formulae proposed in this study will be useful for clinicians, anatomists, anthropologists and forensic scientists.

Keywords: Greeva, Pramana, Height, Anthropometry, Correlation, Regression

INTRODUCTION

In Ayurveda, Anguli Pramana is taken as the basic unit for measuring linear dimensions of body parts. But Anguli Pramana mentioned in Ayurveda classics is highly individualistic based on the concept of "Swa Anguli Pramana" which is unique for his anthropometric measurement and which may not be same for another person. Hence standardization of Anguli Pramana may result in an error.

In modern Anthropometry the measurement is taken in different units either in cm, inches, span, feet, metre etc. In the present study all the measurements were taken in centimeter as it is internationally accepted standard unit for measuring linear dimensions of body parts.

Greeva (Neck) is one among the Shadanga. It is one of most vital part of the human body, without which human being cannot be picturized as it connects head with the rest of the body. The Pramana of Greeva explained in classics by Sushruta and Charaka is 4 Angula (Angula meant for length of a digit approximately that equates 1.95 cm used in Ayurveda as a standard measurement for measuring the length, 4 Angula equates (7.8 cm) in length.[1,2] Average height of a person mentioned by Charaka is 84 Angula (163.8 cm).[3] According to modern science average height of adult human is 185.6 cm and neck length is 10-12 cm.[4]

Estimation of Height of an individual from the skeletal remains like mutilated or amputated limbs has obvious significance in the personal identification in the events of the murder, accident or natural disasters are mainly concerned with the forensic identification analysis. Many factors like racial, ethnic and nutritional factors play an important role in human development and growth; therefore, different nomograms become necessary for different population.

A correlation of two such anthropometric indices is not found in classics. Till date, most of the researchers on stature estimation have used the length of bones such as femur, tibia, humerus, radius, etc. The data and the research outcome available related to calculation of height from length of neck (Greeva Pramana) is very minimal. Hence this study was taken to fill the lacuna. This study is helpful in estimation of height from the length of neck.

Aim and Objective of the study

To assess relation between Pramana of Greeva with Height of an individual

MATERIAL AND METHODS

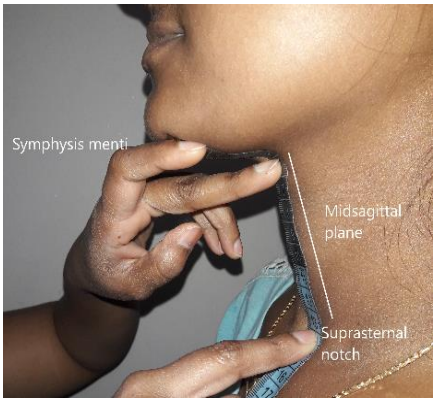
An Observational survey carried out in 400 apparently healthy individuals of age group 25-40 years, irrespective of gender, religion and socioeconomic status was selected randomly from Suburban area of Hassan. Informed consent from volunteers was taken and measurements were recorded by fixing the anatomical points as standard. Participants consents were taken prior to study. Study is carried out as per International conference of Harmonization-Good Clinical Practices Guidelines (ICH-GCP).

Ethical clearance number for this study is: SDM/IEC/49/2017-2018.

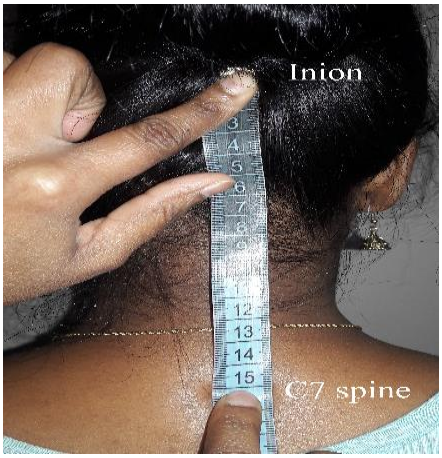
Measurement of Greeva Pramana using standard measuring tape

- Anterior Neck length (ANL) was measured by surface distance from suprasternal notch to the symphysis menti in the mid sagittal plane of the jaw and neck.
- Posterior neck length (PNL) was measured between two fixed bony points i.e. inion and tip of spinous process of 7th cervical vertebra with head in neutral position.
- Average neck length (AVNL) was obtained by addition of anterior neck length and posterior neck length divided by two.

Method of taking measurement of Neck length



Anterior Neck length



Posterior neck length

Measurement of Stature by using Stadiometer

The standing Height was measured between vertex and heal on the floor using Stadiometer in standing posture of the subject with barefoot with head oriented in eye-ear (Frank fort) plane.

Method of measuring the total height of an individual in standing position

Standing Height

Standing Height

Stadiometer

Inclusion Criteria

- Healthy individuals from 25-40 years.
- Apparently healthy individuals irrespective of sex, religion and socio-economic status.

Exclusion Criteria

- Degenerative changes.
- Pregnancy.
- Individuals who had undergone neck surgeries and any medical interventions related to head and neck.
- Individuals with thyroid, obesity and allied disorders of neck.

Statistical analysis

The data was tabulated, analyzed and subjected to statistical analysis using SPSS software (statistical package for social science) version 23.

RESULT

Table 1: Height and Neck length according to gender

Male			
Measurements	Max	Min	Mean
Height	205	134.5	166.95
Anterior neck length	18.5	11	14.67
Posterior neck length	17	10	13.19
Average neck length	17.75	10.5	13.93
Female			
Height	178	134.5	157.96
Anterior neck length	17.5	11	13.75
Posterior neck length	16.5	10	12.27
Average neck length	17	10.5	13.02

Table 2: Total mean of individual Height and Neck length

Measurements	**Total mean**
Anterior neck length	12.65
Posterior neck length	14.13
Average neck length	13.39
Height	161.66

Table 3: Pearson's correlation between Greeva Pramana and Height

Neck Length	Total Number of the individuals	Pearson Correlation Coefficient (*r*)	P –value
ANL	400	0.406**	**0.001**
PNL	400	0.425**	**0.001**
AVNL	400	0.418**	**0.001**

P –value significant at < 0.005**

Table 4: Regression Analysis

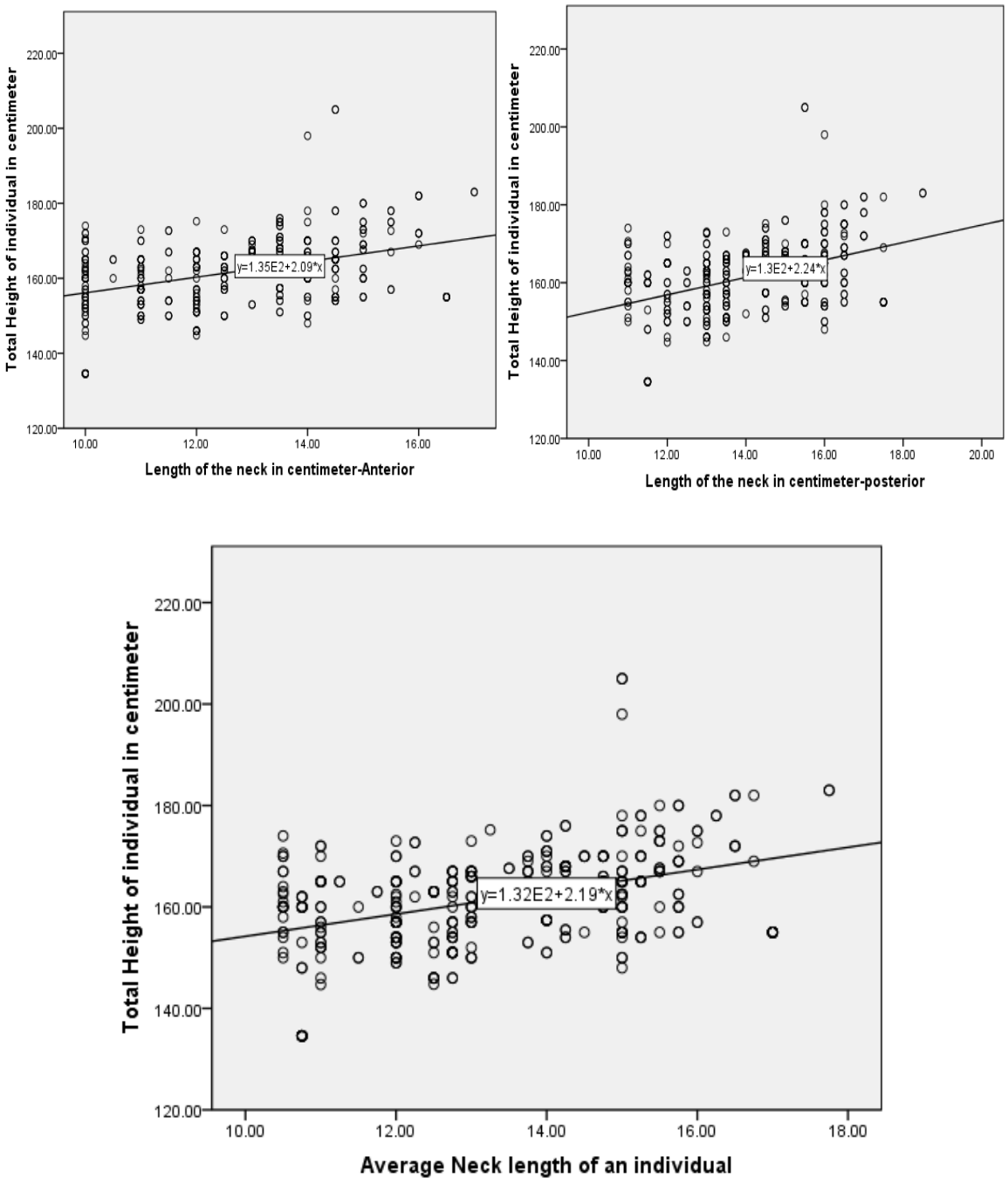
Coefficients[a]						
Model		**Unstandardized Coefficients**		**Standardized Coefficients**	**T**	**Sig.**
		B	**Std. Error**	**Beta**		
1	(Constant)	135.263(b_0)	3.006		44.992	**0.001**
	Mean Anterior neck length	2.087 (b_1)	0.235	0.406	8.873	**0.001**
2	(Constant)	129.964	3.409		38.120	**0.001**
	Mean Posterior neck length	2.243	0.239	0.425	9.371	**0.001**
3	(Constant)	132.290	3.230		40.958	**0.001**
	Mean Average Neck length	2.193	0.239	0.418	9.175	**0.001**

P-value significant at < 0.005
a = dependent variable (Height of the individual), b = independent variable (Neck length)

Table 5: Regression Equation for Estimation of Stature from Greeva Pramana (Neck measurement)

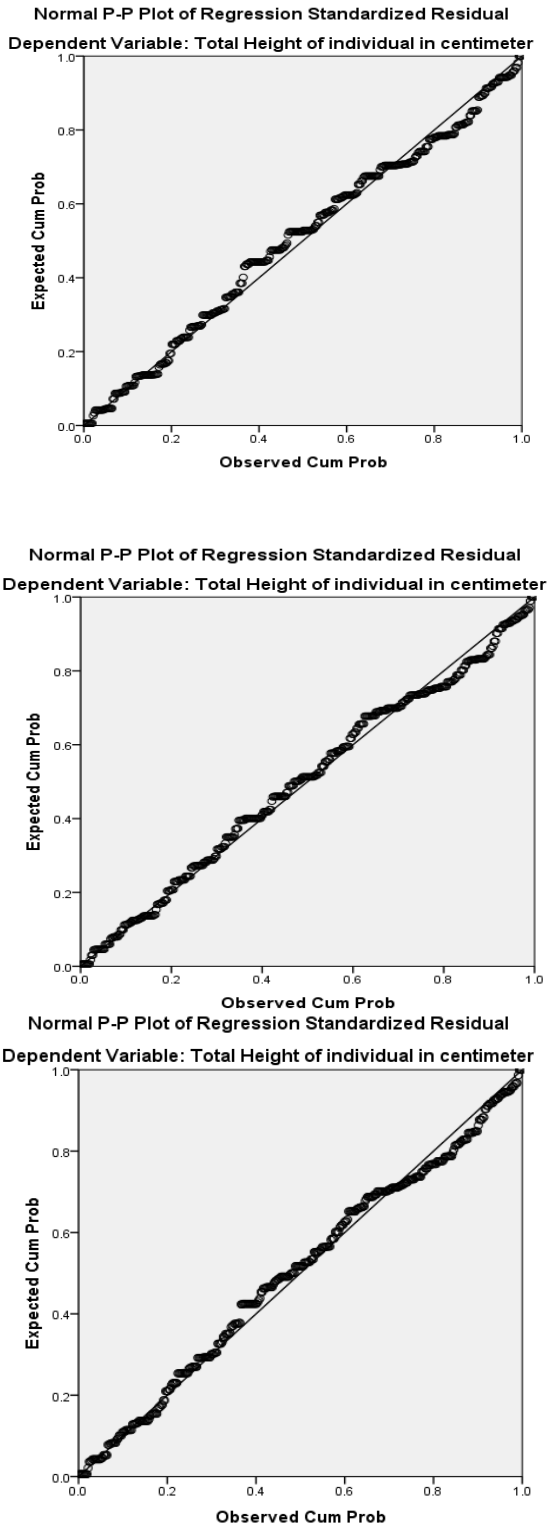
Neck measurements	**Regression Equation**
Anterior neck length	Height = 135.26 + (2.087×12.65)
Posterior neck length	Height = 129.96 + (2.243×14.13)
Average neck length	Height = 132.29 + (2.193 ×13.39)

Dependent variable = intercept + (coefficient × independent variable)
Height = constant (bo) + regression coefficient (b1) × neck length



In the above scatter plots the Regression Standardized score (y-axis) is approximately constantly spread across the Regression Standardized Predicted Value (x-axis). So the criterion of homoscedasticity (equal error variance) is satisfied for proceeding to Linear Regression Analysis for total height and neck length of 400 individuals.

Graph 1: Scatter Plot of test homoscedasticity for Anterior, Posterior and Average neck length



In the above normal p-p plot of regression standardized residuals, the points are along the diagonal line, so the residuals are normally distributed.

Graph 2: Normal P-P plot of Regression Standardized residual for Anterior, Posterior and Average Neck length and Height of the individuals

DISCUSSION

An observational survey study was conducted on 400 apparently healthy individuals from suburban area of Hassan. The sample size taken was as per the population estimation which was statistically significant for research outcome and suitable for survey. Age group between 25-40 years has been chosen as it is ideal for anthropometric study. All the measurements were taken in morning at a fixed time interval as the height varies in various hours of the day. Height will be maximum in the morning and less by 1.5-2 cm in the evening due to reduction of elasticity of inter-vertebral disc. Elasticity of intervertebral discs and cartilage reduce by age leading to reduction in stature. The decrease is generally regarded to be approximately half inch (approximately 1 cm) per decade after the age of 40 years.[6] Hence this age group and time of collection of data is considered for this study.

Among 400 individuals 58.75 % (235) were females and 41.25% (165) were males. Mean Anterior neck length, Posterior neck length and Average neck length were 12.65 cm, 14.13 cm and 13.39 cm respectively. Average height of the body was 161.66 cm.

The above Table 1; describes that the Average height and neck length of the males were found higher than females. Because one of the factor that contribute to height is the genetic factor. More height in men contributed mainly by two genes i.e. gene on chromosome 15 and Y chromosome. Y chromosome is only present in the male and chromosome 15 consists of CYP16 gene codes for aromatase enzyme which converts testosterone into estrogen in both genders. But estrogen level is significantly higher in females as compared to males. It stimulates the closure of epiphyseal growth plate so it ceases growth in females.[7]

In the present study, the variables Greeva Pramana and height are continuous and paired, so statistical test of Pearson's correlation was used to find the correlation between Greeva Pramana and height of the individuals.

In this study, a positive correlation was found between anterior neck length and height of the individuals with correlation coefficient (listed in Table 3), r (Anterior neck length) = 0.406; $p < 0.005$, with Anterior neck length explaining 16.5% of the variability in the height of the individuals; r (Posterior neck length) = 0.425; $p < 0.005$, with Posterior neck length explaining 18.1% of the variability in the height of the individuals and r (Average neck length) = 0.418; $p < 0.005$, with Average neck explaining 17.5% of variability of the dependent variable, total height of 400 individuals.

In above discussion a positive correlation between Greeva Pramana and Height was established. This correlation can be used further to predict the height of the individual.

Height prediction from Greeva Pramana (Neck measurements)

Although variety of methodologies have been proposed to predict stature from long limb bones, regression analysis proved to be the easiest and the reliable method. Correlation coefficient between the total body height and Greeva Pramana were found to be statistically significant and positive indicating a Moderate relationship between the two parameters. Regression models for stature prediction were formulated using Greeva Pramana and checked for their accuracy by comparing the estimated stature and the actual stature. The results further confirmed that Greeva Pramana provides an accurate and reliable means in stature prediction. The Greeva Pramana was proven to be superior to arm span measurement and neck length[8] in predicting height. Furthermore, the linear regression equations of Height of an individual from Greeva Pramana has definitive advantage in finding Average Height of an individual in case of fragmented and dismembered human neck.

In this study, linear regression is statistically established between Greeva Pramana and height of the individuals. The anterior neck length is significantly predicted as, $F(1,398) = 78.725$, $p < 0.005$, and account for 16.5% of the explained variability in the height of the individual. The regression equation is Height = 135.263 + (2.087 × Mean Anterior neck length. Similarly, Posterior neck length could statistically significantly predict height of the individuals, $F(1,398) = 87.823$, $p < 0.005$, and Posterior neck length account for 18.1% of the explained variability in the height of the individual. The regression equation is Height = 129.96 + (2.243 × Mean Posterior neck length). The Average neck length could statistically significantly predict height of the individuals as, $F(1,398) = 84.180$, $p < 0.005$, and Average neck length account for 17.5% of the explained variability in the height of the individual. The regression equation is Height = 132.29 + (2.193 × Mean Average neck length).

CONCLUSION

The present survey study shows that positive correlation between neck length and height of an individual. Out of 400 apparently healthy individuals surveyed for anthropometric study it was observed that the height of the individuals was proportional to the neck length. In individuals having more height, the length of the neck was also more and it was seen proportional to that height. Men were having more height and neck length (both anterior and posterior neck length) than women. This study will be more informative in Forensic science for human identification and further helpful for physicians, Anatomists and surgeons.

The study also helped in deriving formula for estimation of height of an individual by neck length.

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