International Multidisciplinary Research Journal 2012, 2(11):01-04
ISSN: 2231-6302
Available Online: http://irjs.info/

INTERNATIONAL MULTIDISCIPLINARY RESEARCH JOURNAL

Study of craniofacial skeletal patterns and body measurements in south Indians

Suchitra S. Prabhu[1], Ramakrishna Avadhani[2], Rohan Mascarenhas[3] and Praveen Kumar Neela[4].

[1]Assistant Professor, Department of Anatomy, Kannur Medical College, Anjerakandi . Kannur, Kerala, India - 670612.
[2]Professor and Head of the department, Department of Anatomy, Yenepoya Medical College, Yenepoya University, Mangalore, India – 575018.
[3]Professor , Department of Orthodontics, Yenepoya Dental College,Yenepoya University, Mangalore, Karnataka, India – 575018.
[4]Senior Lecturer, Kamineni Institute of Dental Sciences. Narketpally, Dist.Nalgonda, Andra Pradesh, india.

Abstract

Introduction: Craniofacial skeletal pattern and body measurements have been studied in anthropology, orthodontics, cosmetology and garment industries. The purpose of this study was to find the relationship between craniofacial skeletal pattern and body measurements, Ratios and BMI.

Methods: Digital lateral cephalogram was recorded for all the two hundred subjects and were traced and analysed using six cephalometric measurements to identify craniofacial skeletal pattern. These two hundred subjects were divided into three groups Vertical, Horizontal and Average. Then twenty five subjects from each group were randomly selected for this study. Each subject's height, weight, chest, waist and hip were measured and the ratios and BMI were derived. Data was tabulated and statistically analysed.

Results: Waist measurement showed significant difference between Vertical and Horizontal groups. The body mass index showed significant differences between Vertical and Average group. However, there were no significant differences in any measurements taken between Horizontal and Average.

Conclusion: The data recorded by the present study shows that waist and BMI are significantly associated with each other between three groups. We would like to conclude by suggesting that these data can be used in identifying the craniofacial skeletal patterns in early age and preventive methods can be used in cardiovascular risk factors. Additionally these results can be used by forensic anthropologists as well as fashion designers to correlate the ratio and craniofacial skeletal patterns.

Keywords: Craniofacial skeletal pattern,Cephalogram,Vertical,Horizontal, Average,BMI

INTRODUCTION

Physical attraction attributes to a person's physical traits and health and reflects their ethnic, cultural and social background. The body measurements and indices of people vary because of differences in anatomical features which may be influenced by environmental or geographical factors. This brings about difference in their bony shape and fat distribution. Body measurements are useful in identification of individuals in medico legal cases, medical diagnosis and also in anthropological studies.

Human growth is an outcome of complex interactions between genes and the environment. Human beings undergo a synchronized balance of growth and development of bodily components throughout the prenatal and postnatal phases. This interplay of growth and development is affected by many factors.

The body shape of a person may have a genetic basis, especially, who resides in the same environment for many generations. A comparison of stature and body proportion between blacks (African-Americans) and whites (European-Americans) in the United States provides an example of genome-environment interactions and their affect on growth.[1]

Human adult body proportions are brought about by differential growth of the body segments. The body shape is represented by skeletal structure, the muscle built, fat and ratios of chest, waist and hip. When we express the body shape it will represent attractiveness as well as health. The description of ideal measurement and shape is quite difficult because of the demographical distribution and differences.[2]

The general pattern of human body shape development is a species-specific characteristic. Historical artwork, sculpture and anatomical drawings from Renaissance Europe[3, 4] and pre-Columbian Mexico[5] shows fundamental similarities in the depiction of body shape of late term fetuses, newborns and infants. Discrete populations of living humans, however, present a diversity of body sizes and shapes.

In olden days the body and face proportions were based on the art and sculpture. Now it is referred based on population averages from growth studies using cephalometric radiography [6] and anthropometry.[7]However these have their own limitations[8]

Extensive literature survey did not reveal any study relating the craniofacial growth pattern and body measurements. Hence the present study was done to find relationship between craniofacial growth pattern and body measurements, ratios and BMI in males.

MATERIALS AND METHODS

Two hundred males, of South Indians, in the age group of 18-24 reporting to the department of orthodontics and dentofacial orthopedics of YennopoyaUniversity were selected for this study.

Received: Oct 10, 2012; Revised: Nov 15, 2012; Accepted: Dec 23, 2012.

*Corresponding Author
Suchitra S. Prabhu
Assistant Professor, Department of Anatomy, Kannur Medical College,
Anjerakandi. Kannur, Kerala, India - 670612.

Tel: +91-9447653326
Email: suchithra21@gmail.com

Subjects suffering from malnutrition and with a history of surgery were excluded from this study. Purpose of this study was conveyed and consent was obtained from all subjects. This study was approved by ethical committee of Yennopoya University.

Digital lateral cephalogram was recorded for all the two hundred subjects. All lateral cephalograms were traced and six cephalometric measurements were used to identify and categorise the subjects according to craniofacial skeletal pattern. To determine the combined tracing, localization, and measuring error, 25 randomly selected cephalograms were retraced 15 days after they were first evaluated. No significant difference (P >0 .05) was found between the first and second measurement.

The six parameters used in this study for identifying craniofacial skeletal patterns are

1. FMA-Frankfort-Mandibular plane Angle,
2. Y axis
3. Growth axis
4. Lower anterior facial height (LAFH)
5. Sn-Go-Gn angle
6. Jaraback ratio

To be included in a particular type, four of the above six criteria should be met. The parameters used along their normal values for a particular type (table- 1). According to above criteria, the subjects were divided into Vertical, Horizontal and Average types.25 subjects from each group were selected randomly for the study.

Table 1.

PARAMETERS	AVERAGE	VERTICAL	HORIZONTAL
FMA	18°-22°	>22°	<18°
Y axis	58°-61°	>61°	<58°
Growth axis	88° -92°	<88°	>92°
LAFH	65-70mm	>70mm	<65mm
Sn-Go-Gn	28°-32°	>32°	<28°
Jaraback ratio	62-65	<62	>65

Then Height, weight, chest, waist, hip measurements were taken for all 75 subjects (25 in each group) who were randomly selected. Weight was measured in kilogram. Height, chest, waist and hip measurements were taken in centimeters, using an inch tape. Chest measurement was taken across the fullest part of chest. Waist is measured at the smallest circumference of the abdomen. Hip was measured at the largest circumference of the hips and buttocks. From these measurements chest-hip ratio, waist-chest ratio, waist-hip ratios were calculated for all 75 subjects. For all subjects, Body Mass Index (BMI) was also computed. The formulae used to compute the above ratio and BMI are given in table -2

Table 2.

Type of ratio	Formulae
Waist hip ratio(WHR)	Waist measurement ÷ Hip measurement
Waist chest ratio(WCR)	Waist measurement ÷ Chest measurement
Chest hip ratio(CHR)	Chest measurement ÷ Hip measurement
Body Mass Index(BMI)	Weight/Height^2

Statistical analysis

Microsoft Excel (Microsoft Corp, Redmond, USA) was used to compile the data. Means and standard deviations of the measurements, ratios and BMI of all twenty five subjects in each of the three groups were calculated.

SPSS 14.0 (SPSS, Chicago, Illinois, USA) was used for statistical analysis. Unpaired t-test was used to compare between these measurements, ratios and BMI in all the three groups. The statistical analysis was carried out to compare the following groups using unpaired 't' test.

Vertical and Horizontal group.
Vertical and Average group.
Horizontal and Average group.

RESULTS

The values of the mean standard deviation of all the measurements, ratios and BMI are given in Table 3.

PARAMETERS	GROWTH PATTERN		
	HORIZONTAL Mean# SD	VERTICAL Mean#SD	AVERAGE Mean# SD
HEIGHT	170.85±7.65	171.38±3.62	169.95±6.83
WEIGHT	63.35±11.77	61.1±6.94	62.75±8.25
WAISTCIRCUMFERENCE	75.7±6.85	71.2±6.31	74.475±6.36
HIPCIRCUMFERENCE	88.525±6.54	85.15±5.21	86.5±6.86
CHESTCIRCUMFERENCE	83.5±7.82	81.225±5.53	83.9±5.44
WAIST HIP RATIO	0.8565±0.045	0.836±0.04	0.865±0.087
WAIST CHEST RATIO	0.9105±0.085	0.877±0.033	0.8895±0.054
CHEST HIP RATIO	0.9425±0.057	0.9525±0.027	0.9705±0.047
BMI	21.55±2.760	20.33±1.417	21.73±2.574

Summary of the result of comparison between the parameters of three groups:

Table-4 shows that there is no statistically significant difference between any measurements in Vertical and Horizontal group except in the waist measurement.

Table-5 shows that there is no statistically significant difference between any measurements in Vertical and Average group except BMI.

Table-6 shows that there is no statistically significant difference between any measurement, ratio or BMI in Horizontal and Average group.

Table 4. Comparison between the Vertical with Horizontal group

Parameter	VERTICAL	HORIZONTAL	t-value	p-value
Height	171.375	170.85	0.277615	0.782
Weight	61.1	63.35	0.73652	0.465
Waist	71.2	75.7	2.16027	0.037
Hip	85.15	88.525	1.80552	0.078
Chest	81.225	83.5	1.06309	0.294
Waist hip ratio	0.836	0.8565	1.61358	0.114
Waist chest ratio	0.877	0.9105	1.63815	0.109
Chest hip ratio	0.9525	0.9425	0.708273	0.483
BMI	20.233	21.5565	1.90737	0.062

Table 5. Comparison between the Vertical with Average group

Parameter	VERTICAL	AVERAGE	t-value	p-value
Height	171.375	169.95	0.824394	0.414
Weight	61.1	62.75	0.68457	0.497
Waist	71.2	74.475	1.63511	0.110
Hip	85.15	86.5	0.70095	0.481
Chest	81.225	83.9	1.54337	0.131
Waist hip ratio	0.836	0.865	1.39011	0.172
Waist chest ratio	0.877	0.8895	0.88908	0.379
Chest hip ratio	0.9525	0.9705	1.49523	0.143
BMI	20.233	21.7305	2.27891	0.028

Table 6. Comparison between the Horizontal with Average group

Parameter	HORIZONTAL	AVERAGE	t-value	p-value
Height	170.85	169.95	0.39254	0.696
Weight	63.35	62.75	0.18675	0.852
Waist	75.7	74.475	0.58593	0.561
Hip	88.525	86.5	0.95536	0.345
Chest	83.5	83.9	0.18794	0.851
Waist hip ratio	0.8565	0.865	0.38909	0.699
waist chest ratio	0.9105	0.8895	0.9304	0.358
Chest hip ratio	0.9425	0.9705	1.69195	0.098
BMI	21.5565	21.7305	0.20616	0.837

DISCUSSION

During the years of growth and development humans can grow more or less of various tissues and come to be adults of various sizes and shapes. As adults these sizes and shapes are largely fixed, especially for total stature and the length of body segments. Human growth is highly plastic during the years of growth and development, responding to the overall quality of living conditions[9]

The differences seen among the people are because of genetical predisposition to gain weight or to store fat around the abdomen and chest. It is also possible that humans have a genetic drive to eat more than they need for the present in order to store energy for future. This is called the thrifty gene hypothesis.[10]

Before puberty both males and females have a similar ratio. When they attain puberty the hormonal changes bring variation in the ratio between two sexes.[11] On an average, males have around ten times more testosterone than women.

The present study was done to find any significant difference between various craniofacial skeletal patterns and body measurements, ratios and BMI.

In the present study Vertical and Horizontal groups showed a significant difference in waist circumference among the three groups. In December 2008, the World Health Organization (WHO) convened a consultation to discuss cut-points for waist circumference (WC), as wc is influenced by body weight, body composition and fat distribution. Fat distribution also differs in both the gender, with men having relatively more central distribution of fat. These differences begin in early life and become more apparent in puberty due to changes in sex hormone levels.[12]

In both men and women, waist and waist-to-hip ratio increase with age and body weight. Waist-to-hip ratio has been found to be a more efficient predictor of mortality in older people than waist circumference or body mass index.[13]The waist–hip ratio takes account for the differences in body structure. Waist hip Ratio greater than 0.9 is an indicator of central obesity which is a risk factor for

cardiovascular diseases. In the present study the overall waist hip ratio is 0.8, in Horizontal group 0.8, in Vertical group 0.8 and in Average group 0.8.

In the present study the waist chest ratio is 0.9, 0.8and 0.9 in Horizontal, Vertical and Average groups respectively and overall waist chest ratio is 0.9. The chest hip ratio is 0.9 in both Horizontal, and Vertical groups and in Average group it is1.0. Overall chest hip ratio is0.9.

Body Mass Index (BMI) is an excellent indicator for the weight status of a person. Its significance also lies in the fact that the values indicate the effect of body weight in diseases and death, irrespective of the age and gender of an adult person.

A healthy BMI for adults is between 19 and 24.9and a high BMI is predictive of death from cardiovascular disease, diabetes, high blood pressure. The BMI also allows us to judge the nutritional status of an individual. A BMI of less than 18.5 is considered to denote under nourishment.[14] The BMI used along with the WHR is a better factor in predicting risk for many of the serious diseases such as diabetes, high blood pressure, lipid disorders and atherosclerosis leading to heart attacks and strokes etc. Asian Indians have a high BMI, and abdominal obesity and excess fat.[14]Inthe present study Vertical and Average groups show there is significant difference in BMI. In Horizontal and Average group there was no significant difference in any of the parameter that was compared. Gupta et al, (2007) in their study have shown that increasing obesity measured by BMI&WC is associated with increasing prevalence of multiple cardiovascular risk factors. According to them though fat distribution plays an important role in the pathophysiological mechanisms of obesity, its relation to other diseases in practical prevention can be used only in individual counseling.

CONCLUSION

The data recorded by the present study shows that waist and BMI are significantly associated with each other between three groups. These data can be used in identifying the craniofacial skeletal patterns in early age and preventive methods can be used in cardiovascular risk factors. Additionally these results can be used by forensic anthropologists as well as fashion designers to correlate the ratio and craniofacial skeletal patterns.

REFERENCES

[1] Fulwood R, Abraham S, Johnson C. 1981. Height and weight of adults ages 18−74 years by socioeconomic and geographic variables *Vital and Health Statistics Series* 11, No. 224, 81-1674.

[2] Horvath T. 1981. "Physical attractiveness: the influence of selected torso parameters". *Arch Sex Behav.* 10 (1): 21–4.

[3] Boyd E. Savara BS, Schilke JF. 1980 In: Origins of the Study of Human Growth. Editors University of Oregon Press; Eugene, OR, USA.

[4] Tanner JM. 1981. A History of the Study of Human Growth. University of Cambridge Press; Cambridge, UK.

[5] Tate C, Bendersky G. 1999. Olmec sculptures of the human fetus. *Perspect. Biol. Med.* 42:303–332.

[6] Coghlan, Tom; Pitel, Laura; Gray, Sadie. "Women seduced by 'V man' with a matted chest". London: timesonline.com

[7] Scammon RE, Calkins LA. 1929. The Development and Growth of the External Dimensions of the Human Body in the Fetal Period. University of Minnesota Press; Minneapolis, MN, USA.

[8] "Assess your weight". Heart and Stroke Foundation of Canada. Retrieved 10/9/2011.

[9] Bogin B.1999. Patterns of Human Growth. 2nd ed. Cambridge University Press; Cambridge, UK.

[10] Neel JV, Weder AB, Julius S. 1998.Type II diabetes, essential hypertension, and obesity as "syndromes of impaired genetic homeostasis": the "thrifty genotype" hypothesis enters the 21st century. *PerspectBiol Med.* 42:44–74.

[11] "Secondary sexual characteristics occur as part of the pubertal process". Retrieved10/9/2011.

[12] Stevens J, Katz EG, Huxley RR.2010. Associations between gender, age and waist circumference *Eur J ClinNutr.*64(1):6-15.

[13] Price GM, Uauy R, Breeze E, Bulpitt CJ, Fletcher AE. 2006"Weight, shape, and mortality risk in older persons: elevated waist-hip ratio, not high body mass index, is associated with a greater risk of death". *Am. J. Clin. Nutr.*84 (2): 449–60.

[14] ChamukuttanSnehalatha,VijayViswanathan,AmbadyRamachandran.2003.Cutoff Values for Normal Anthropometric Variables in Asian Indian Adults.*Diabetes care* 26 (5) 1380-1384.

[15] R Gupta, PriyankaRastogi, MSanna, VP Gupta, SK Sharma, K Kothari. 2007. Body mass index, waist size waist hip ratio and cardiovascular risk factors in urban subjects. *JAPI* 55:621-627.