



## **Discrepancy between Self-reported and Recorded Age and Height among Students: a Forensic Anthropological Investigation**

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**Abstract.** Age and stature estimation have apparent implications in personal identification in the events of murder, accidents or natural disaster mainly concern with forensic identification analysis. Self-reported anthropometric data is convenient and inexpensive, but relying on this data requires an accurate estimation of age and height. The biasness, precision, and accuracy of adult's self-reported age and height across subpopulations were examined using a representative sample of adults. Aim of the present study is to report bias in an individual's reported and documented age and height estimates. The study sample were included more than 200 young adult students (100 male and 100 female subjects approximately) from Panjab university, Chandigarh, age from 18 to 25. Linear and multiple regression analysis were done to formulate equations which would be helpful for estimation of stature and age from self-reported data for both male and females. The best correlation estimation in multiple and linear regression equations for age estimation in male was shown self-reported data whereas in females reported to be data from parents rather than self-reported data, females tends to decrease their age number as shown in results while in stature best variable is self-reported. The weakest correlation was reported to be data from close friends in both males and females.

**Keywords:** Self-reported; Stature; Age; Discrepancy; Anthropometric.

### **1. Introduction**

Forensic anthropology is the sub-discipline that applies the principles and methods of physical anthropology to legal issues and identifying unknown individuals is a key part of forensic anthropology. The main aim of anthropologists employed in the

forensic/ medico legal department, working with unknown variable is to describe the remains in such terms so that one can achieve the goal of estimating age, at the time of the time of death, sex, stock/race/ancestry stature, body weight, details of individualizing characteristics either amputation, fractures, ankylosis, deformities and bone pathologies remains bones<sup>1-3</sup>. Stature reconstruction is an important factor in stature estimation, it provides forensic anthropological estimate of the height of a person in the living state, playing a vital role in the identification of individual. Estimation of stature from hand length plays an important role in identifying the deceased in forensic examination<sup>4</sup>.

Estimation of stature has evident significance in personal identification in the events of murder, accidents or natural disaster mainly concern with forensic identification analysis. Therefore personal identification is an integral part of investigation in cases of mass disasters where disintegrated and amputated body organs are found very frequently<sup>5</sup>.

Assessment of age at the time of death is one of the foremost duties in forensic investigation. In legal provisions, estimation of age at time of death is the fundamental aspect in identification procedures. In forensic context, age determination is a fundamental but crucial question for investigating crimes, mass disasters or war crimes where a number of unknown victims are to be identified. Judicial requirements, time and the accuracy of the age range are basic factors in developing identification procedures, though it is also one of the most difficult aims to achieve in forensic anthropological investigations<sup>2,3</sup>. The use of reported stature and age, especially self-reported stature and age such as on a driver's license, as a proxy for measured stature is necessary when stature measured is unavailable. Self-reported anthropometric data is convenient and inexpensive, but relying on this data requires accurate estimations<sup>6,7</sup>. Data consistently demonstrate under-reporting of age and over-reporting of height. Under-reporting of age occurs particularly among women and conversely, height tends to be over-reported, regardless of sex<sup>8-11</sup>. Assessing the accuracy of self-reports would help employers, researchers, and policy makers determine the validity of financial estimates related to healthcare utilization and absenteeism. The objective of this study is to provide a guide line of information for the law enforcement agencies, forensic anthropologist, security experts and forensic medicine discipline experts in estimating correct age and stature figures for

missing persons with biasness towards accuracy in self-reported figures in order to achieve personal identify of unknown missing living or recently dead individuals.

## 2. Materials and methods

The study sample were included more than 200 young adult students (100 male and 100 female subjects approximately) age from 18 to 25, belonging to various socio-economic backgrounds of nearby states and were studying in Panjab university, Chandigarh. This study was irrespective of caste, religion, dietary habits & socio-economic status of the respondents and was being chosen randomly.

Measurements of stature were recorded on barefoot subjects. Because of the diurnal variation in stature, all subjects were measured approximately in the afternoon. Care has been taken for inclusion of unrelated subjects only. Those with normal gait and motion activity were included in study. Measurements are recorded during period between March and April on barefoot subjects. Students having significant growth disorders, deformities, bony anomalies are excluded to rule out any gross anomaly in measurement of stature.

Measurements:

(i) Measured/recorded height: - It is measured as vertical distance from the vertex to the floor. Measurements were taken by making the subject to stand erect on a horizontal resisting plane bare footed with shoulder blocks and buttocks touching the wall. Palms of hand were turned inwards and fingers horizontally pointing downwards. Stature measurements were taken from the wall by standard anthropometric instrument. To minimize subjective errors all the measurements were taken three times and then mean were taken.

(ii) Reported stature and age:

a. They were asked to report their height and age on a questionnaire embedded in a so-called health survey (Appendix I).

b. Reported stature and age from their parents or family and their close friends

After the self reported, participants' actual height was measured.

(iii) Age on their valid id cards were recorded also.

All the subject's information were filled in Performa (Appendix II).

### 3. Statistical analysis

Data were analyzed using IBM SPSS Statistics Software (Version 21) (IBM Corp., Armonk, NY, 2012)<sup>12</sup>. Bilateral asymmetry (difference between the recorded and reported stature and age within an individual) were calculated. The significance of bilateral asymmetry was tested by applying a paired sample t-test. Karl Pearson's correlation coefficients between measured and reported data of the stature and age were obtained separately. Scatter plots were also generated. A simple scatter plot uses a 2-D coordinate system to plot two variables. The analyses included means, standard deviations and ranges.

### 4. Results

Descriptive statistics of all data about variables of self-reported age, reported age from valid Id-proof, reported age from parents, reported age from close friend, measured stature, self-reported stature, reported stature from parent, reported stature from close friend on study of 200 subjects were shown in tables.

**Table 1.** Descriptive Statistics for all variables for male and female subjects. Min.:minimum; Max.:maximum; SD: standard deviation.

Variables	Males (N=100)				Females (N=100)			
	Min.	Max.	Mean	SD	Min.	Max.	Mean	SD
Self Reported Age	19	26	23.29	1.76	18	23	21.26	0.77
Reported Age from ID Proof	19	26	23.56	1.83	18	25	22.08	1.18
Reported Age from Parents	19	26	22.88	1.68	18	25	21.71	1.05
Reported Age from Close Friend	19	28	23.58	1.69	20	24	21.20	.84
Measured Stature (in cm)	154.0	176.8	167.18	6.02	142	172.4	156.08	6.37
Self-Reported Stature (in cm)	155.4	189.4	170.87	7.47	149	182	161.91	7.08
Reported Stature from Parent (in cm)	156	190	175.37	7.77	149	187	165.59	7.87
Reported Stature from Close Friend (in cm)	161.5	198	185.17	7.72	150	184	166.69	9.21

It was observed in taken measurements that actual stature of males and females were between 154 -176.8 cm and 142.6 -172.4 cm, respectively., whereas for actual age of males and females which were recorded from their ID-proof were between 19 to 26 year and 18 to 25 year, respectively.

The significance of bilateral asymmetry was tested by applying a paired t-test. All the variables showed highly significant at level ( $p < 0.000$ ). Bilateral asymmetry (difference between the measured stature or actual age with reported stature or age) were calculated for each variable taken in Performa (Appendix II) in Table 2.

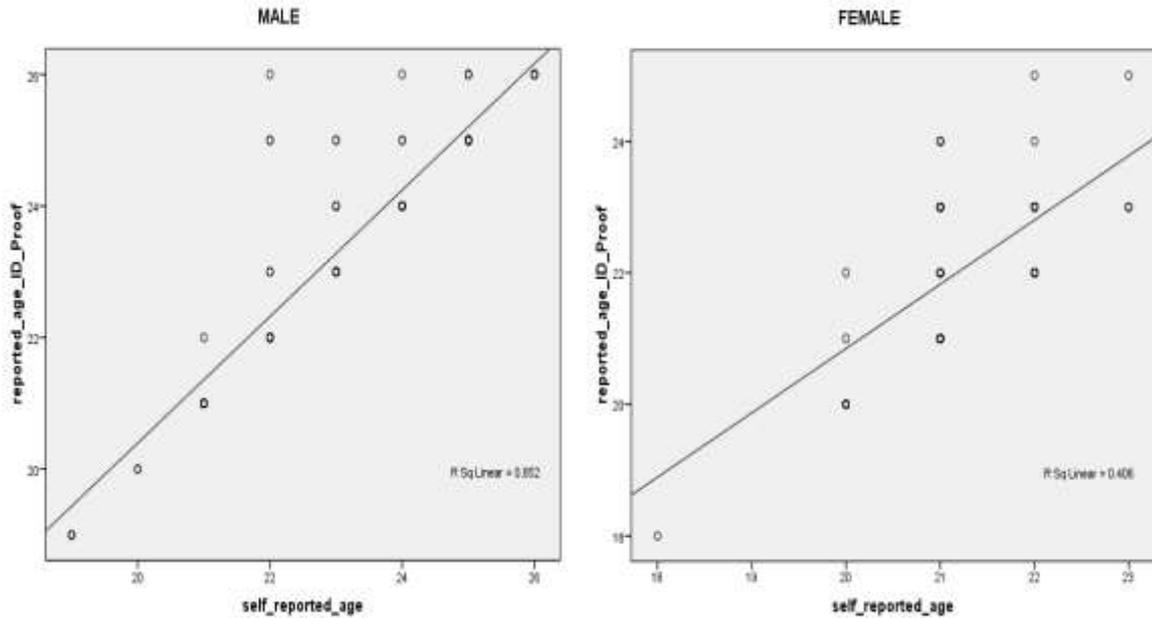
**Table 2.** Bilateral asymmetry (difference between the recorded and reported age or stature) were calculated for each of the variable taken in Performa (Appendix II).

T-test value between	Male	Female	For both
Self-Reported stature and Recorded stature by anthropometric rod	-8.430	-16.274	-16.293
Reported stature of subject from their family and Recorded stature by anthropometric rod	-13.866	-17.187	-21.779
Reported stature of subject from their close friend and Recorded stature by anthropometric rod	-25.068	-12.723	-23.521
Self-Reported age and Recorded age from valid proof	-3.810	-8.969	-8.950
Reported age of subject from their family and Recorded age from valid proof	-6.082	-7.318	8.443
Reported age of subject from their close friend and Recorded age from valid proof	0.130	-6.480	4.004

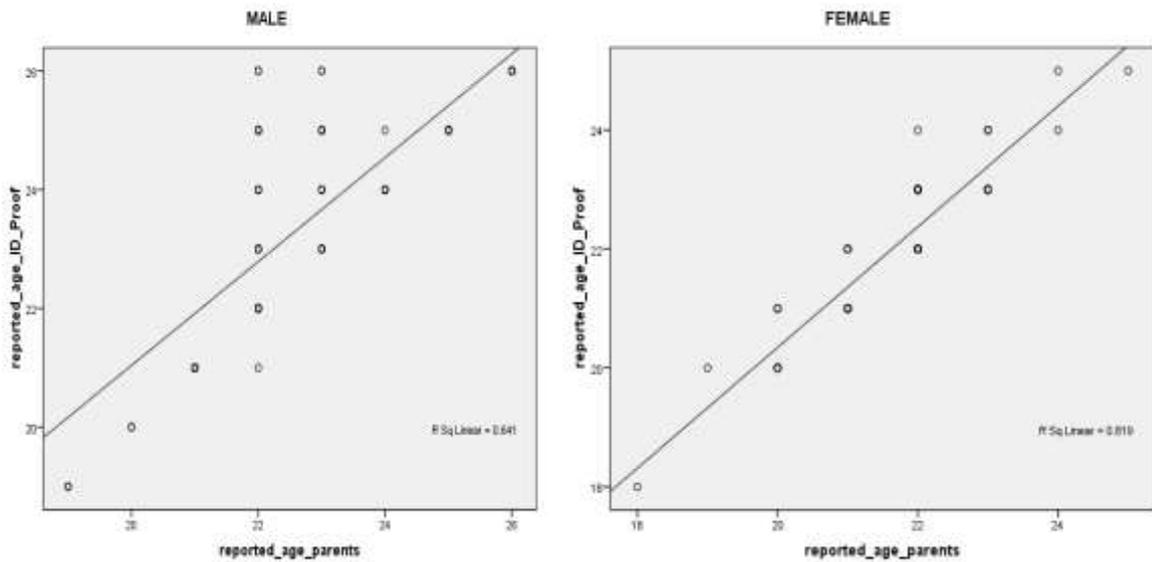
**Table 3.** Regression equation between actual age (from valid ID card) and from self-reported, reported from parents and close friend, Actual stature (measured from anthropometric rod) and stature from self-reported, reported from parents and close friend for male and female subjects. R: correlation Coefficient;  $R^2$ : coefficient of determination; Ad. $R^2$ : Adjusted  $R^2$ ; SE: Standard error.

Variables	MALES				FEMALES			
	R	$R^2$	Ad. $R^2$	SE	R	$R^2$	Ad. $R^2$	SE
Actual age (from valid ID card) and from self-reported, reported from parents and close friend	0.94	0.89	0.89	0.61	0.91	0.823	0.82	0.51
Actual stature (measured from anthropometric rod) and stature from self-reported, reported from parents and close friend	0.81	0.66	0.65	3.54	0.87	0.75	0.74	3.22

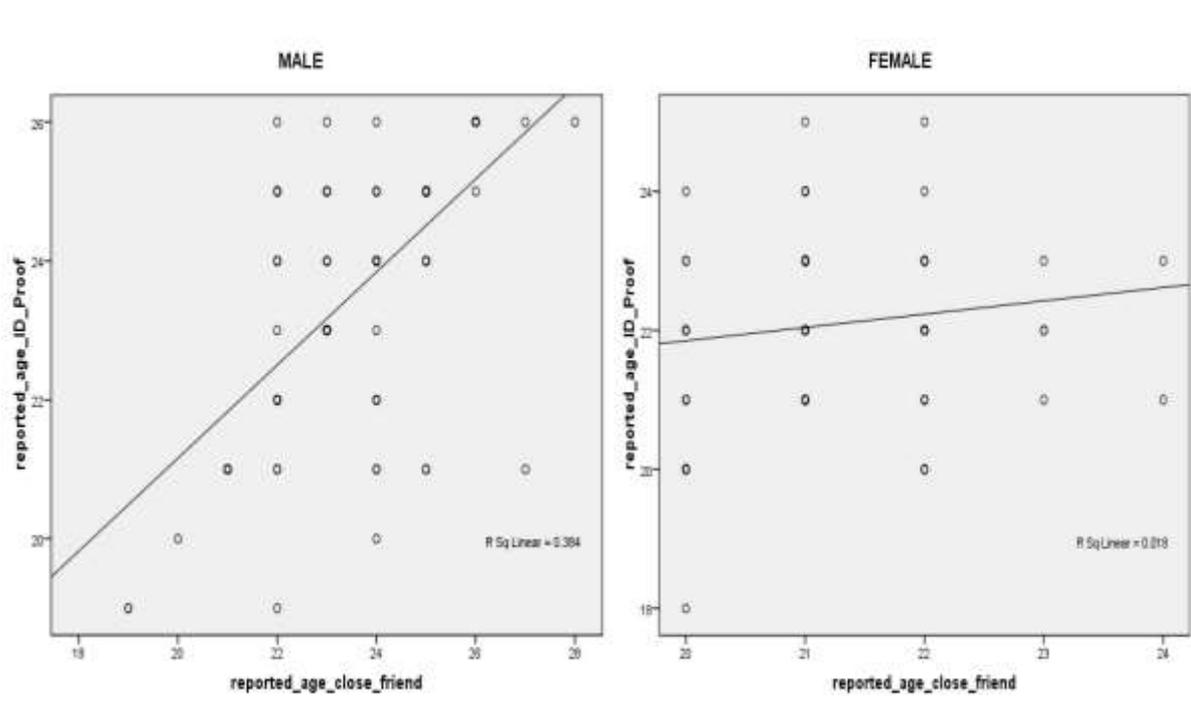
Further scatter plots were drawn; it can help you determine potential relationships among scale variables.



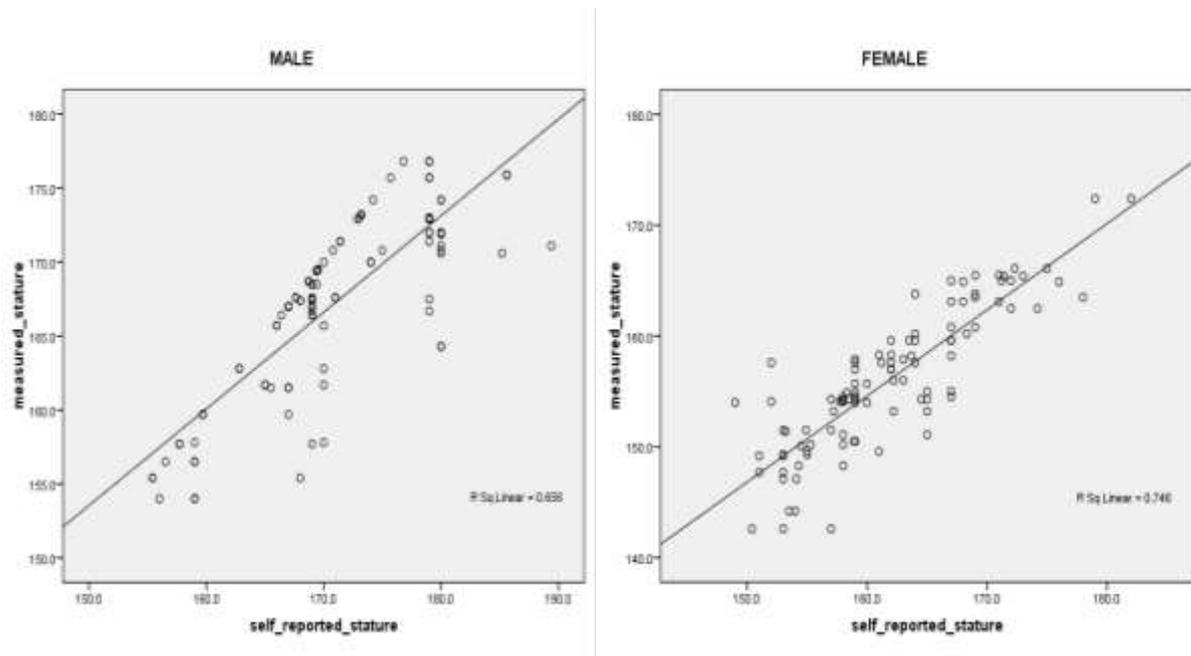
**Figure 1.** Scatter plot between variable actual age (from valid ID card) and from self-reported age for male (left) and female (right) subjects.



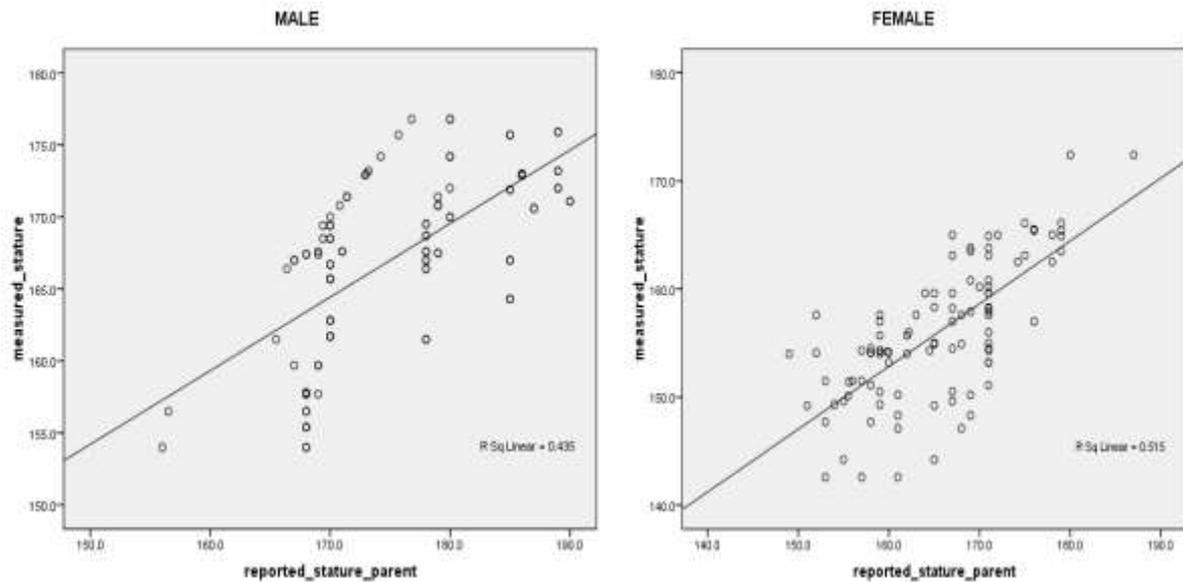
**Figure 2.** Scatter plot between variable actual age (from valid ID card) and from reported from parents age for male (left) and females (right) subjects.



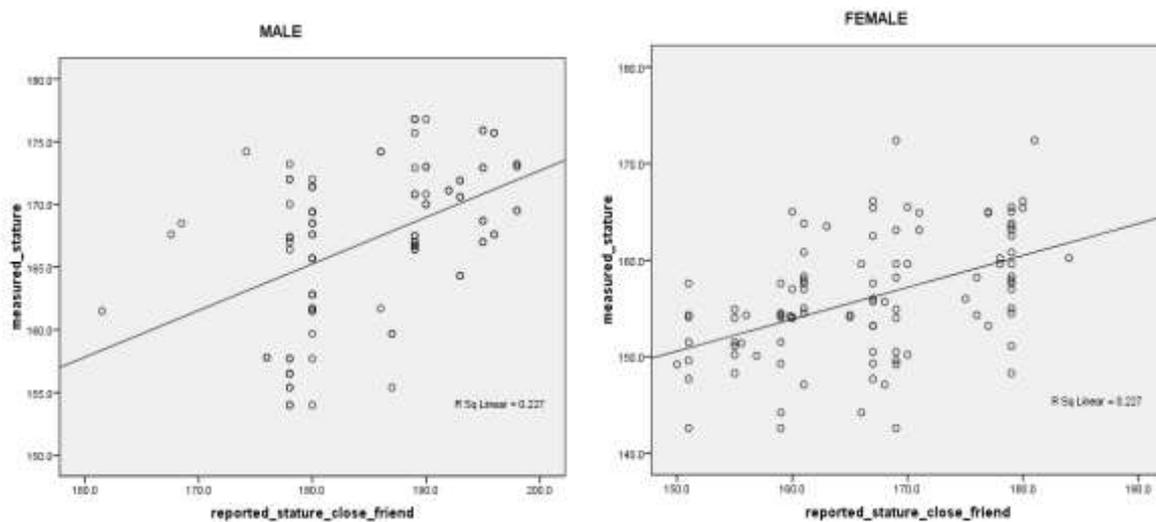
**Figure 3.** Scatter plot between variable actual age (from valid ID card) and from age reported from close friend for male (left) and females (right) subjects.



**Figure 4.** Scatter plot between variable measured stature (from anthropometric rod) and from self-reported stature for male (left) and females (right) subjects.



**Figure 5.** Scatter plot between variable measured stature (from anthropometric rod) and from stature reported from parents for male (left) and females (right) subjects.



**Figure 6.** Scatter plot between variable measured stature (from anthropometric rod) and from reported stature from close friend for male (left) and females (right) subjects.

Multiple regression analysis between actual age (from valid ID card) and: self-reported age, reported from parents, close friend variables were shown in Table 3; Standard error (SE) was 0.614 for male and 0.507 for female. Regression equation between actual stature (measured from anthropometric rod) and stature from self-reported, reported from parents and close friend for male and female subjects were shown in Table 3. Standard error estimation (SE) for male was 3.5 and for female

were 3.22. The multiple regression analysis for age estimation for both males and females between actual age and self-reported age, reported from parents and reported from close friend were 0.852 ( $R^2$ ) and for stature estimation for both sexes were shown as 0.806 ( $R^2$ ). The age and stature correlation coefficients determined for males were  $R^2 = 0.891$  and  $R^2 = 0.664$ , respectively. On the other hand, the respective coefficients for females were  $R^2 = 0.823$  (age) and  $R^2 = 0.752$  (stature).

The weakest correlation in age estimation showed in the scatter plots came from close friends, having  $R^2 = 0.384$  for males and  $R^2 = 0.018$  for females. Regarding stature estimation, the weakest correlation came from close friend, with  $R^2 = 0.227$  for males and  $R^2 = 0.227$  for females. The best correlation in age estimation showed in the scatter plots came from the self-reported variable, with linear  $R^2 = 0.852$  for males; for females, the best age correlation came from parents, having  $R^2 = 0.819$ . Best correlation for stature estimation came from the self-reported value, with  $R^2 = 0.656$  and  $R^2 = 0.746$  for males and females, respectively.

## 5. Discussion

Self-reported anthropometric data is convenient and inexpensive, but relying on this data requires an accurate estimation of age and height. Data consistently demonstrate over-reporting of height and there is no literature found on self-reported age. Giles *et al.*<sup>13</sup> studied the accuracy of self-reported stature for 8000 U.S. Army personnel that the amount of general overestimation of stature by men is 2 1/2 times greater than that by women. Neither tall men nor tall women underestimate their stature, but men in the upper third of the stature range, and women in the upper 10%, self-report their stature with greater accuracy. Engstrom *et al.*<sup>8</sup> had done integrative review of the literature on the accuracy of self-reported height and weight in women and to examine factors associated with the accuracy of self-reported height and weight measurements in women. Implications of the findings for clinical practice and recommendations for further research are discussed. Brener *et al.*<sup>9</sup> studied the reliability and validity of self-reported height and weight, and variables calculated from these values, in a diverse sample of adolescents. White students were more likely than those in other race/ethnic groups to over report their height, and the tendency to over report height increased by grade. Female students were more likely than male students to underreport their weight. Junilla *et al.*<sup>10</sup> studied the accuracy of using female college students' self-reports of weight and height in estimating rates of

overweight. Gozzi *et al.*<sup>11</sup> studied an impressive discrepancy between reported and measured parental height. Women of tall stature estimated the heights of their short partners correctly, whereas heights of normal statured men were underestimated. On the other hand, tall men overestimated the heights of their female partners who are of normal and short stature. Bes-Rastrollo *et al.*<sup>14</sup> conducted a study to evaluate the validity of self-reported anthropometrics in adult Adventists of USA and Canada and found that participants underestimated their weight by 0.20 kg, and overestimated their height by 1.57 cm resulting in underestimation of body mass index (BMI) by 0.61 kg/m<sup>2</sup>). Leone *et al.*<sup>15</sup> studied female college freshmen (n=128) self-reported weight and height, then underwent measurements for weight, height, waist circumference, and body fat percentage. Despite no differences in self-reported versus directly assessed weight or height for the total group, students with high waist circumference and excess fat under-reported their weight by 2.3±4.4 lb (p < 0.05). Self-reporting bias was negatively correlated with waist circumference (r = -0.362; p < 0.001) and body fat percentage (r = -0.317; p<0.001). Self-reported anthropometric data is convenient and inexpensive, but relying on this data requires accurate estimation. Data consistently demonstrate under-reporting of age and over-reporting of height. Under-reporting of age occurs particularly among women and conversely, height tends to be over-reported, regardless of sex. Assessing the accuracy of self-reports would help employers, researchers, and policy makers determine the validity of financial estimates related to healthcare utilization and absenteeism.

In this present study both male and female subjects yielded positive correlation coefficient and coefficient of determination. The regression equations further confirmed the reliability of the findings of this study. There is also reported sexual dimorphism that exists in the parameters of both male and female. Linear regression equation and multiple regression equation are drawn which were helpful for estimation of stature and age from self-reported data for both male and females.

The best correlation estimation in multiple linear regression formulas for age estimation in male was self-reported data whereas in females reported was from parents rather than self-reported , females tends to decrease their age number as shown in results while in stature best variable was self-reported. The weakest correlation was reported by close friends in both males and females. As we noted earlier, bias in self-rating is of concern in a variety of research areas. In particular, the

potential for recalibration of self-rating bias as a function of material or skills learned in an intervention has long been a concern to programme evaluators as it may result in underestimates of programme effectiveness, it may reduce the accuracy results in forensic cases.

This highlights the disparity in measures, the need for more empirical studies and implicitly has not address the biasness in the subjectivity of the subjective indexes.

## References

1. Šlaus M, Strinović D, Pećina-Šlaus N, Brkić H, Baličević D, Petrovečki V, et al. Identification and analysis of human remains recovered from wells from the 1991 War in Croatia. *Forensic Sci Int.* 2007 <https://doi.org/10.1016/j.forsciint.2006.10.003>
2. James SH, Nordby JJ. *Forensic Anthropology. Forensic Science: An Introduction to Scientific and Investigative Techniques.* (3rd Edn). CRC Press. Boca Raton, Fla. 2009;101-135.
3. Stewart TD (1979). *Essentials of Forensic Anthropology, Especially as developed in the United States.* Charles C. Thomas, Springfield, U.S.A.
4. Karaman AG, Teke HY, Gunay I, Doğan B, Bilge Y. Height estimation using anthropometric measurements on X-rays of wrist and metacarpal bones. *Internet J Biol Anthropol.*2008;2(1). <https://doi.org/10.5580/627>
5. Wilson RJ, Herrmann NP, Jantz LM. Evaluation of stature estimation from the database for forensic anthropology. *J Forensic Sci.*2010; 5 (3): 684-689. <https://doi.org/10.1111/j.1556-4029.2010.01343.x>
6. Wang Z, Patterson CM and Hills AP. A comparison of self-reported and measured height, weight and BMI in Australian adolescents. *Aust N Z J Public Health.*2002;26:473– 8. <https://doi.org/10.1111/j.1467-842X.2002.tb00350.x>
7. Abalkhail BA, Shawky S and Soliman NK. Validity of self-reported weight and height among Saudi school children and adolescents. *Saudi Med J.* 23;2002:831–7.
8. Engstrom J L, Paterson SA, Doherty A, Trabulsi M and Speer KL. Accuracy of self-reported height and weight in women: An integrative review of the literature. *J Midwifery Womens Health.*2003; 48(5): 338-345. [https://doi.org/10.1016/S1526-9523\(03\)00281-2](https://doi.org/10.1016/S1526-9523(03)00281-2)
9. Brener ND, Mcmanus T and Galuska DA. Reliability and validity of self-reported height and weight among high school students. *J Adolesc Health.*2003;32:281–7. [https://doi.org/10.1016/S1054-139X\(02\)00708-5](https://doi.org/10.1016/S1054-139X(02)00708-5)

10. Junilla KL, Machteld O, Rutger Engels, Rob E and Tatjana VS. Validity of self-reported weight and height and predictors of weight bias in female college students. *Appetite*.2008;50: 386–389. <https://doi.org/10.1016/j.appet.2007.09.002>
11. Gozzi T, [Flück C](#), l'allemand D, [Dattani MT](#), [Hindmarsh PC](#) and [Mullis PE](#). Do centimetres matter? Self-reported versus estimated height measurements in parents. *Acta Paediatr*.2010;99(4):569-74. <https://doi.org/10.1111/j.1651-2227.2009.01654.x>
12. IBM SPSS (2012) Statistics for Windows, version 21.0, Armonk, NY: IBM Corp.
13. Giles E and Hutchinson DL. Stature- and age-related bias in self-reported stature. *J Forensic Sci*,1991;36(3):765-80. <https://doi.org/10.1520/JFS13087J>
14. Maira BR, Joan S, Karen JS and Gary EF. Validation of self-reported anthropometrics in the Adventist Health Study 2. *BMC Public Health*.2011; 11:213. <https://doi.org/10.1186/1471-2458-11-213>
15. Ryan J. Leone, Amy L. Morgan, and Mary-Jon Ludy. Validation of Self-Reported Anthropometrics in Female College Freshmen. *International J Exercise Sci*.2016; 9(1): 47-55.

## Appendix I

### SUBJECT INFORMATION

Name: \_\_\_\_\_

Father name: \_\_\_\_\_

Age: \_\_\_\_\_ Gender: M / F

Date of Birth: \_\_\_\_\_

Height: \_\_\_\_\_

Telephone: \_\_\_\_\_ Email: \_\_\_\_\_

### GENERAL HEALTH:

1. In general, would you say your health is:

Excellent

Very Good

Good

Fair

Poor

2. Compared to one year ago, how would you rate your health in general now?

Much better now than one year ago

Somewhat better now than one year ago

About the same

Somewhat worse now than one year ago

Much worse than one year ago

3. Health History – Do you have a history of any of the following?

- Heart disease Yes/ No  
Heart attack Yes/ No  
Stroke Yes/ No  
Elevated cholesterol Yes/ No  
Elevated triglycerides Yes/ No  
Any other vascular condition Yes /No  
Do you have a history of Cancer? Yes /No  
If so, which type: \_\_\_\_\_

4. Family History

Have either of your parents, or any of your siblings diagnosed with, or died of, any of the following cancers? (Check mark in the box indicates yes, please check all that apply)

- colon or rectal                       endometrial                       kidney  
 prostate                               bladder                               pancreas  
 throat                                   brain or spinal cord                       cervical  
 mouth                                   stomach                                   ovarian  
 liver                                       lung                                       breast  
 Other: \_\_\_\_\_

5. Have any of your parents or siblings died of heart disease, heart attack or stroke?  
Yes/ No

6. Have any of your parents developed Diabetes Mellitus for age 60?  
Yes/ No

**Appendix II**

**PERFORMA**

Name: \_\_\_\_\_

Name of Institution: \_\_\_\_\_

Age: \_\_\_\_\_ Gender: M / F

Time during recorded stature by anthropometric rod: \_\_\_\_\_

Self-Reported stature from questionnaire \_\_\_\_\_  
Self-Reported age from questionnaire \_\_\_\_\_  
Reported stature of subject from their \_\_\_\_\_  
family \_\_\_\_\_  
Reported age of subject from their \_\_\_\_\_  
family \_\_\_\_\_  
Reported stature of subject from their \_\_\_\_\_  
close friend \_\_\_\_\_  
Reported age of subject from their close \_\_\_\_\_  
friend \_\_\_\_\_  
Recorded age from valid proof \_\_\_\_\_  
Recorded stature by anthropometric rod \_\_\_\_\_