

Prediction of stature from arm-span-An Anthropometric study on 100 Bangladeshi adult Muslim male of Lower socioeconomic status group.

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Abstract :

To determine the stature from arm-span may be needed in the older persons whose original stature have already reduced due to aging process or unable to take actual measurement of a person due to curvature of vertebral column abnormality i.e. kyphosis, lordosis and scoliosis or partial loss or total loss of the lower limb or bowing of legs and bent knees. Sometimes it is impossible to take measurement of bed ridden patients. In these cases the original stature of those people can be measured by multiplying the measuring value of the arm-span with the multiplication factor. The multiplication factor can be obtained by making ratio of the stature to the arm-span. This multiplication factor varies from one race to another race, one sex to another sex and one ethnic group to another ethnic group. Therefore the present study was carried out in order to establish a multiplication factor of Bangladeshi adult Muslim male of lower socio-economic status group. The sample subjects were 100 Bangladeshi Muslim males of lower socio-economic status aged between 25 to 30 years. The arm-span along with stature was measured directly from the subject by measuring steel tape. The data were then statistically analyzed by computation to find out its normative value. Comparison was made between measured and estimated stature of the same person by using paired "t" test. In the study the multiplication factor was revealed 0.940 ± 0.038 .

Introduction:

In 1930 Heris and coworker reported a close relationship between arm-span and stature. Whilst this was one of the earliest systematic anthropometric studies in man, it was Leonar da vinci who first drew attention to the association of arm-span and stature. In recent years arm-span has been proposed as a proxy for stature notably subjects such as the elderly who show extensive spinal curvature. Standing the relation ships between arm-span and stature can be useful in other clinical contexts, such as when the stature can not be measured properly due to disability and deformity. The arm-span can even be used to account for age related height loses.¹ The arm-span is

alternative measure to body height in Caucasians, Africans, Americans, Afro Caribbeans and Asians.²

As early as the first century AD, the Roman architect Vitruvius noted the equivalent relationship of arm-span and stature; this proportionality was also depicted by Leonardo davinci in his famous 'Diagram of Man.' Because

of this assumed equality of the two measures, arm-span has frequently been used as a basis for estimating age-related loss in stature and has been suggested as an alternate measure to height when height can not be measured directly due to deformity, contracture or missing legs.³

Aging is associated with several Physiological, Psychological and biological changes including body composition such as an increase in body fat and decrease in lean body mass and also bone mass. This can lead to change in body posture and thinning of vertebral discs which can lead to a reduction in height or even kyphosis in elderly person with osteoporosis.⁵

Materials:

Trotter and Glesser in 1951 used 30 years as the age when stature decrease begins but Galloway in 1988 and Cline et al in 1989 reported that stature loss begins around 45 years of age.⁶ Investigators have shown that mean loses 1.2cm ($\frac{1}{2}$ inch) in stature every 20 years after the age of 30.⁶

For aging it has been shown that the older the individual (after 30 years of age) the greater will have been his loss of stature. It was found that the average rate of decline is .06 cm per year after 30 years of age.⁷

Studies have shown that females lose more stature with aging than males.⁴

By keeping in mind the above citation the age limit of the subjects in this study was determined from 25 to 30 years because this age limit is safe and there is no chance for change in the maximum stature and the study was carried out on 100 adult Muslim males of lower socio-economic status group of Bashaboo slum areas of Dhaka City.

All measurements were taken at fixed time i.e. from 7.30 AM to 2 PM to prevent the discrepancies of diurnal variation. The duration of collection was from July/2006 to October/2006. The analyses were conducted in the department of Anatomy of BSMMU, Dhaka during the study period of January 2006 to December 2006.

Common exclusion criteria :

- Subjects with bowing legs and bent knees.
- Subjects with vertebral column curvature abnormality i.e. kyphosis, lordosis, scoliosis etc.
- Persons who are suffering from chronic ailment.
- Left handed subjects.
- Subjects with missing limb or part of limb.

Methods:

If each subject is measured twice and the mean value of the two measurements is considered the best estimate of

the true value.³ In this study each subject was measured twice and the mean value of the two measures was taken as true value of the subject.

Procedure of the measurement of the stature (Height of the body in a standing position) :

The subject stood with heel together and back as straight as possible. The heels, buttocks, shoulders and the head touched the wall. The arms were hung freely by the sides with the palm facing the thighs.⁸ After taking a deep breath and holding it, a carpenter's square was placed against the head and the wall to determine maximum height on the wall and this was marked.

Participants were then told to breathe and to step away from the wall. Height was then measured from the floor to the mark on the wall with steel tape.⁹

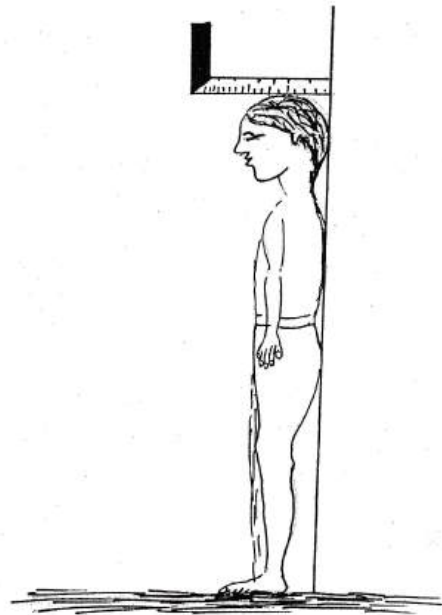


Fig.-1: Procedure of the measurement of stature.

Procedure of the measurement of the arm-span:

A 30 meter long steel tape measure was employed for the arm-span measurement and the reading was taken to the nearest 0.1cm. Arm-span was measured while the subject was standing erect and looking straight ahead with the back against the wall to provide support. The arms were outstretched at right angle to the body with palm facing forwards. The measurement was taken from one middle finger tip to the other middle finger tip with

the tape passing in front of the clavicle. The field worker supported the elbow during measurement.¹⁰

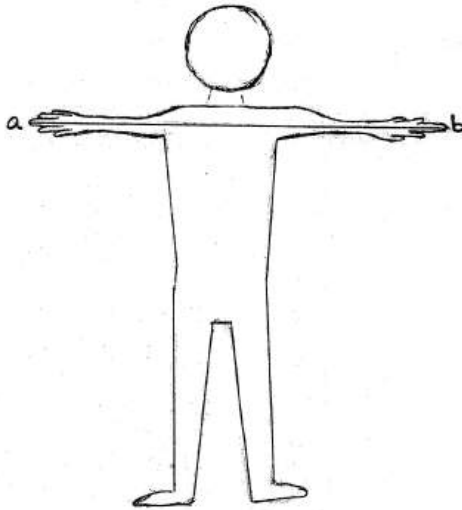


Fig.-2: Procedure of the measurement of the arm-span.

Calculation of multiplication factor :

The multiplication factor is the ratio of the stature to the arm-span. The mean multiplication factor was then calculated. This mean multiplication factor would be used for estimating the stature from the arm-span.

Multiplication factor (M.F) =

Statistical analyses of data :

The collected data were calculated using a computer based programme (SPSS and MS Excel) to get mean values, correlation, frequency distribution and significant of the differences etc.

Result :

Figure 3 Shows that more Than four fifth of the total subjects had the stature within 150.1 cm to 170.0cm. Very small number of the subjects had the stature within 140.1cm to 150cm and within 170.0cn to 180.0cm. Figure 4 shows that four fifth subjects had the arm-span within 160.0cm to 180.0cm and one fifty number of the subjects had the arm-span within 150.0cm to 160.0cm and 180.1cm to 190.0cm. The mean values of the measured stature and the arm-span were 163.70 ± 5.986

cm and 173.389 ± 7.013 cm respectively and the mean multiplication factor was 0.940 ± 0.038 .

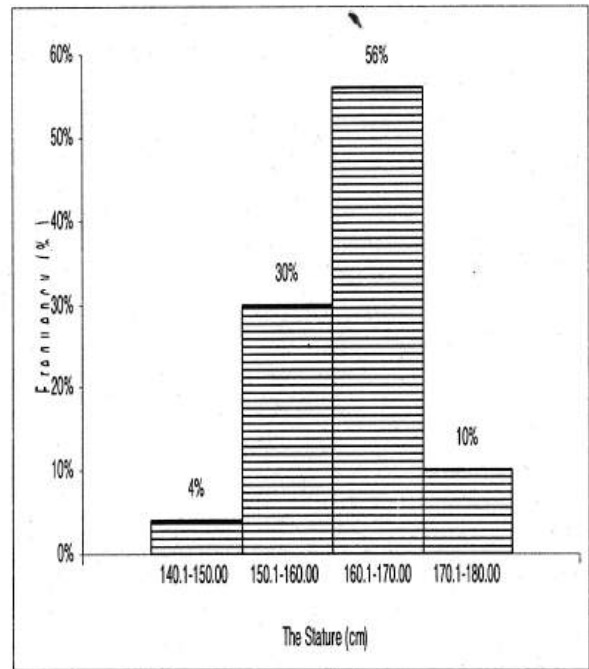


Fig 3: Histogram showing the frequency distribution of the measured stature (n = 100).

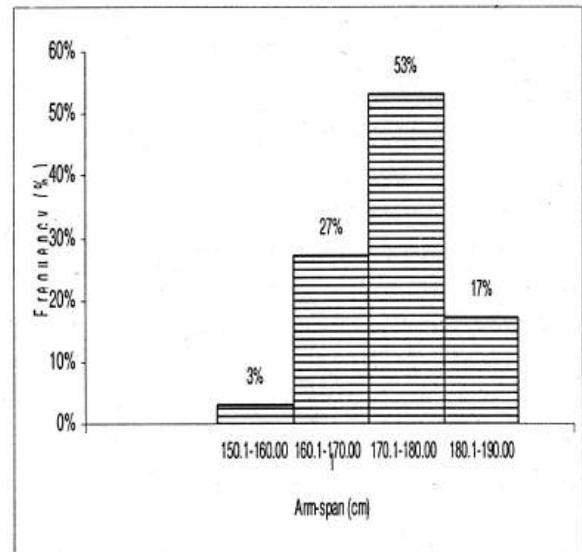


Fig 4: Histogram showing the frequency distribution of the arm-span (n = 100)

The estimated value of the stature of a person was find out by multiplying his arm-span with the mean multiplication factor.

The mean value of estimated stature from multiplication factor was 162.903 ± 6.613 cm and there was no statistically significant difference between measuring value and estimated value of stature and the P value was $P = 0.727$. This comparison was done in order to prove the accuracy of the multiplication factor.

The regression analysis shows highly significant ($P < .001$) positive correlation between the measured stature and the arm-span of the individuals.

($n = 100$, $r = 0.801$, $p = 0.000$).

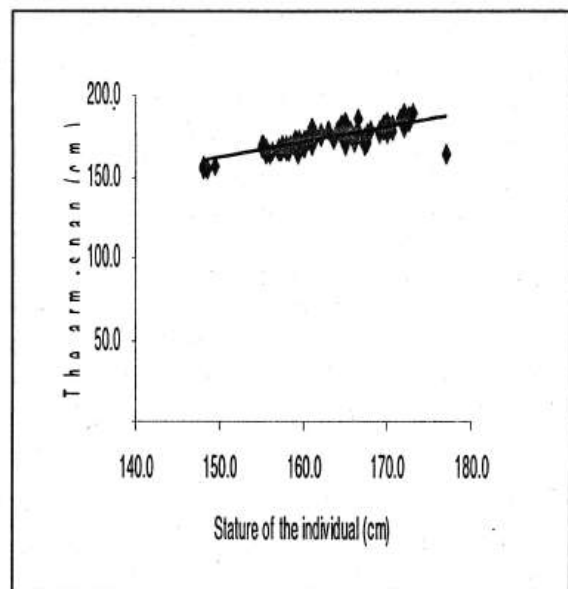


Fig 5: Scatter diagram with regression analysis showing significant ($p=0$) positive

Discussion:

Reeves et al.¹ worked on 272 males of varying nationalities and reported that the arm-span of Afro-Caribbean, Asian, Caucasian and Oriental males were $182.4 (\pm 10.20)$ cm, $177.6 (\pm 0.800)$ cm, $181.3 (\pm 8.28)$ cm, $172.8 (\pm 7.46)$ cm. respectively and the ratio between stature and above four arm-spans were 0.961, 0.972, 0.988, 0.989 respectively and there was positive correlation between the stature and the arm-span. All the arm-span values and the ratios are greater than that of the present study.

Lucia et al.¹⁰ worked on 884 males of four regions in Ethiopia namely Oromia, Amhara, Tigre and Somali region and reported that the arm-span of Oromo-male, Amhara male, Tigre male and Somali male were $176 (\pm 8.2)$ cm, $176.6 (\pm 7.5)$ cm, $176.6 (\pm 7.3)$ cm and $182 (\pm 8.1)$ cm respectively and the ratios between the stature and the arm-span were 0.955, 0.962, 0.956 and 0.983 respectively. In all cases there were positive correlations between the stature and the arm-span. All the arm-span values and the ratios are greater than that of present study.

Therefore, we need separate multiplication factors for different race, sex and ethnic groups live in Bangladesh and from which stature can be calculated from their arm-span value. Depending on this idea this study was done on 100 Bangladeshi adult Muslim males of lower socio-economic status group.

So, the multiplication factor of the study could be used for estimating of stature from arm-span in case of Bangladeshi adult Muslim male of lower socio-economic status group.

Conclusion :

Due to short duration of time this study was done on 100 Bangladeshi adult Muslim males of lower socio-economic status group.

It is suggested that better result can be obtained by using large number of samples sizes.

References:

1. Reeves, S.L., varakamin, C., Henry, C.J.K., 1996. The relationship between arm-span measurement and height with special reference to gender and ethnicity. *European Journal of Clinical Nutrition*, 50, 398-400.
2. Zverev, Y.P., 2003. Relationship between arm-span and stature in Malawian adults. *Annals of Human Biology*, 30(6), 739-743.
3. Steels, M.F., Mattox, J.W., 1987. Correlation of arm-span and height in young woman of two races. *Annals of Human Biology*, 14,445-447.
4. Mc pherson, J.R., Lancaster, D.R., Carroll, J.C., 1978. Stature change with aging in black Americans. *Journal of Gerontology*, 33, 20-25.
5. Shahar, S., Pooy, N.S., 2003. Prediction equation for estimation of stature in Malaysian elderly people. *Asia specific Journal of Clinical Nutrition*, 12(1) 80-84.
6. Meadows, L., Jants, R.L., 1992. "Estimation of stature from. Metacarpal length. " *Journal of Forensic science*, 37(1), 147-154.
7. Trotter, M., Glesser, E.W., 1952. Estimàtion of stature from long bones of American white and Negroes. *American Journal of Physical Anthropology*, 10, 463-514.
8. Frisancho, A.R., 1990, *Anthropometric standards for the assessment of Growth and Nutritional status*. United states of America. The University of Michigan press.
9. Brown., J.K., Feng, J.Y., knapp, T.R., 2002. Is self Related Height or arm-span a more accurate Alternate Measure of Height? *Clinical Nursign Research*, 432-436.
10. Lucia, D.E., Lemma, F., Tesfaye, F., Demisse, T., Ismail, S., 2002. The use of arm-span measurement to assess the nutritional status of adults in four Ethiopian ethnic groups. *European Journal of Clinical Nutrition*, 56, 91 - 95.
11. Lal, C.S., Lala, J.K., 1972, Estimation of stature from tibial and ulnar lengths in North Bihar. *Journal of Indian Medical association*, 58, 120 - 121.