

Association of Height and Arm Span in Young Healthy Subjects

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ABSTRACT

Introduction: Height is used to calculate body mass index and body surface area which are used to interpret renal function test and pulmonary function test. Maximum vertical measurement of a person is the standing height. Arm span is the measurement between the tip of the middle finger of the right and left hands. Exact standing height of patients with abnormalities of disproportionate growth, spine deformities, skeletal dysplasia, limb deformities, amputated limb, pain, weakness or paralysis cannot be measured. In these conditions, arm span may be used to determine the height of a person.

Objective: This study aims to determine the association of height and arm span among the medical students of Maharajgunj Medical Campus, Nepal.

Methods: A cross sectional analytical study was conducted among medical students in Clinical Physiology Department of Maharajgunj Medical Campus from November 2020 to October 2021. Non-probability, convenience sampling method was adopted and a total of 110 participants were enrolled in the study including 55 males and 55 females. Pearson's correlation coefficient was used to find the association between height and arm span. Simple linear regression test was also used to formulate the equations of height and arm span and data analysis was done using SPSS version 25.

Results: A significant positive correlation was observed between height and arm span where the total participants had r -value=0.765(p =0.00), males had r -value=0.557(p =0.00) and female had r -value=0.778(p =0.00).

Conclusions: A strong positive correlation was observed between height and arm span among the participants.

Keywords: Arm span; body height; medical students.

INTRODUCTION

Among the developing countries the burden caused by musculoskeletal disorders showed a rise of 60% from the year 1990 to the year 2010.¹ It was estimated that around 2.35 million people had musculoskeletal disease in Nepal in 2016.² There were 2.1 million elderly inhabitants in Nepal which is 8.1% of the population.³ Body height is used to calculate body mass index and body surface area which are used to interpret renal function test and pulmonary function test.⁴ Once puberty is attained length of long bones do not change.⁵

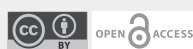
Arm span is the measurement between the tip of the middle finger of the right and left hands which is measured in subjects standing straight against a wall with both hands abducted horizontal at 90 degrees.⁶

Height and weight increase after birth as a process of physical growth. After the age of 19 years a person's height usually does not grow.⁷ Loss of height is seen during the ageing process and begins approximately between the age of 30 years and 50 years.⁸ The loss of height is caused by the postural changes, and decrease in size of the discs in the vertebral column. Clinical conditions like arthritis and kyphoscoliosis can cause difficulty in standing straight which can lead to inaccurate measurement in height.⁹ Height of patients with disproportionate growth, spine deformities, skeletal dysplasia, limb deformities, amputated limb, pain, weakness or paralysis may not be measured accurately.^{10, 11}

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METHODS

A quantitative cross sectional analytical study was adopted for this study. Height was used as an independent variable whereas arm span was used as a dependent variable. The study was conducted in medical students in the department of clinical physiology of Maharajgunj Medical Campus from November 2020 to October 2021 after obtaining ethical clearance from the Institutional Review Committee of Institute of Medicine, Maharajgunj.

A convenience sampling method was used to collect the data. A total of 110 medical students between the age ranges 18 to 25 years participated in the study.

Participants who had skeletal deformities or physical disabilities or who could not stand erect or straighten their knees were excluded from the study. Written informed consent was taken from the participants after explaining about the research procedure. Pearson's correlation coefficient test was used to determine the association between height and arm span. A p value < 0.05 was considered statistically significant. Linear regression was used to formulate an equation of height and arm span and SPSS version 25 was used for data analysis.

RESULTS

A total of 110 medical students with 55 male and 55 female participants were enrolled in the study. The mean age and BMI were more among the male participants in comparison to their female counterparts as shown in table 1.

Table 2 shows a significant positive correlation of height and arm span with a p value <0.001 was observed among the total participants. The male and female participants also showed a significant positive correlation with a p value <0.001 when analyzed separately.

The scatter plots shown in figure 1a and 1b show a positive association of height and arm span among the male and female participants respectively. The estimated equation formulated by simple linear regression for male participants was height = 132 + 0.25 × arm span and for female participants was height = 63.8 + 0.61 × arm span as shown in figure 1a and 1b respectively.

Scatterplot in figure 2 shows a positive correlation of height and arm span among the total participants. The estimated equation formulated by simple linear

Table 1: General Characteristic of the participants according to gender.

Characteristics	Total Participants (n=110)			Females (n=55)			Males (n=55)		
	Mean ± SD	Min	Max	Mean ± SD	Min	Max	Mean ± SD	Min	Max
Age in years	20.1 ± 1.04	18	24	19.8 ± 0.95	18	22	20.24 ± 1.07	18	24
Weight in kg	58.8 ± 10.3	38.8	97	53 ± 8.3	38.8	75	63.6 ± 9.5	45.8	97
Height in cm	167.5 ± 9.6	144	188	160.5 ± 6.3	144	175	174.3 ± 7.06	159	188
BMI in kg/m ²	20.8 ± 2.7	15.29	31.14	20.7 ± 2.7	15.9	28	20.9 ± 2.6	15.29	31.14
Arm span in cm	167.7 ± 15.5	139	276	158 ± 8	139	179	176.7 ± 15.7	158.2	276

Abbreviations: BMI – Body mass index, kg – kilogram, cm – centimeter, m-meter, Min – minimum, Max – maximum

Table 2: Correlation of Height and Arm span among the participants.

	Height and Arm span	
	r value	p value
Males	0.557	0.00**
Female	0.778	0.00**
Total	0.765	0.00**

P value < 0.001**

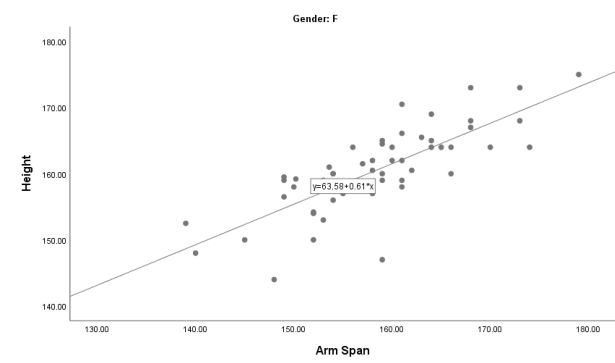


Figure 1 a $r = 0.557$ $p = 0.00$
 $y = 132 + 0.25 \times x$

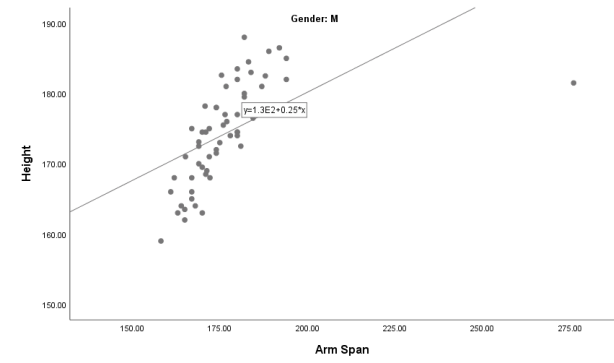
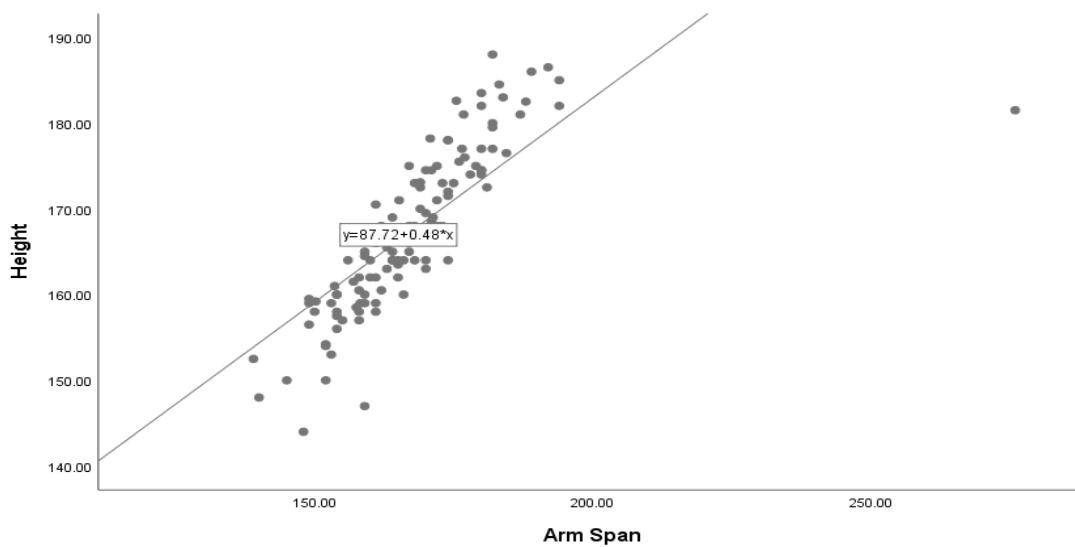


Figure 1 b $r = 0.778$ $p = 0.00$
 $y = 63.8 + 0.61 \times x$

Figure 1: Scatterplot between height and arm span among males and females



$r = 0.765$, $p\text{-value} = 0.00$, $y = 87.72 + 0.48 \times x$

Figure 2: Scatterplot between height and arm span among the total participants.

equation for the total participants was height = 87.72 + 0.48 × arm span.

DISCUSSION

This cross sectional analytical study aims to determine the association of height and arm span among the medical students of Maharajgunj Medical Campus, Nepal. In this study, a significant positive correlation of height and arm span was observed among total participants and also among male and female participants individually. In similarity to this study, Sarma et al. in 2021, North Eastern India showed a significant correlation of arm span and standing height among males ($r=0.988$, $p<0.001$)

and female participants ($r=0.991$, $p<0.001$) however, the mean arms span and height in both male and females were smaller than in the participants of this study.¹² Similarly, a study conducted in Montenegro by Popovic et al in 2018 showed similar results with significant positive correlation of arm span and height, where $r = 0.823$, $p<0.00$ for boys and $r = 0.830$, $p<0.00$ for girls.¹³ Another study conducted by Sah et al, in 2013, Birgunj, Nepal also observed positive correlation height and arm span in both male ($r=0.682$, $r<0.001$) and female ($r=0.507$, $p<0.001$) participants. However, the mean height and arm span of the males was smaller than the participants in the present study.¹⁴

In similarity to our study Rai et al, in 2015, India also reported similar results among 600 participants. There was a significant correlation of height and arm span among the total participants $r=0.921$, p value = 0.0001 as well as among male and female participants.¹⁵

Similarly, Mohanty et al, in 2001, India reported a significant positive correlation between standing height and arm span among the participants. The study also correlated the sitting height and leg length with arm span.¹⁰ A study conducted by Steele et al, also reported similar results but mean arm span was wider than the height in female participants.¹⁶ Similarly, a study conducted by Bjelica et al, in Montenegro, in 2012 also showed a significant positive correlation in both male and female participants. In contrast to this study the females had a shorter mean arm span compared to the height whereas the males had wider arm mean arm span compared to the height in a study done by Bjelica et al.¹⁷ In similarity to this study, Zvezek reported significant correlation of height and arm span among boys and girls.¹⁸ Similarly Jamir et al, in 2013 Haryana reported a significant correlation of height and arm span.¹⁹

Arm span could be considered to be used as an alternative measurement when an accurate height

cannot be assessed. In certain conditions where a person cannot stand, amputees and patients with spinal deformities standing height cannot be measured. In these conditions arm span may be taken in consideration to measure the height as arm span can be easily measured and does not require highly trained personnel.

A larger sample size including a wider age range and multiple centers could give us a better estimation of height using arm span for the general population.

CONCLUSIONS

The study concludes that a significant positive correlation of height and arm span was observed among total participants. So, arm span may be taken in consideration to measure the height of an individual especially in conditions where a person cannot stand, amputees and patients with spinal deformities.

Conflict of Interest: None

NJHS

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