International Journal of Community Medicine and Public Health
Chavhan SP et al. Int J Community Med Public Health. 2020 Apr;7(4):1475-1479
http://www.ijcmph.com
pISSN 2394-6032 | eISSN 2394-6040

DOI: http://dx.doi.org/10.18203/2394-6040.ijcmph20201459

Original Research Article

Correlation of body mass index with biceps and triceps skin fold thickness

Snehal P. Chavhan[1], Mandar V. Chandrachood[2]*

[1]Department of Community Medicine, Dr. D.Y. Patil Medical College, Pimpri, Pune, Maharashtra, India
[2]Department of Community Medicine, BKL Walawalkar Rural Medical College, Sawarde, Chiplun, Ratnagiri, Maharashtra, India

Received: 28 January 2020
Revised: 05 March 2020
Accepted: 06 March 2020

***Correspondence:**
Dr. Mandar V. Chandrachood,
E-mail: drmandar5@gmail.com

ABSTRACT

Background: Body mass index (BMI) and skin fold thickness are independently established methods of nutritional assessment. Present study tries to find out correlation between them.
Methods: A cross sectional study was conducted in private medical college among 2nd year MBBS students. Total 24 students were sampled by purposive sampling method. After obtaining permission from Institutional Ethics committee and written informed consent from participants, study information was gathered using semi structured proforma. Anthropometric measurements were taken using standard techniques and equipments. Data was analysed using Microsoft Excel and Prism version 5.0 and appropriate tests were used considering normality of data.
Results: Out of 24 study participants 14 were males and 10 were females. Mean weight was 59.29±12.59 kg, mean height was 164.77±10.28 cm, mean BMI was 21.68±3.18 kg/m^2. Mean biceps skin fold thickness was 7.20±2.68 mm and mean triceps skin fold thickness was 10.75±3.33mm. Of all the participants 4 (16.67%) were having underweight BMI, 15 (62.50%) were having normal BMI, 5 (20.83%) were pre-obese. BMI correlated significantly with triceps skin fold thickness Spearman's r=0.53, p=0.006 as compared to biceps skin fold thickness Spearman's r=0.36, p=0.07 in complete sample. Among males BMI correlated significantly with triceps skin fold thickness Spearman's r=0.64, p=0.01 as compared to biceps skin fold thickness.
Conclusions: BMI correlates significantly with triceps skin fold thickness as compared to biceps skin fold thickness in general. Significant correlation between BMI and triceps skin fold thickness was found with males as compared to females.

Keywords: BMI, Biceps, Triceps, Skin fold thickness, Correlation

INTRODUCTION

Malnutrition is an important public health problem in developing countries like India and there are multiple methods to asses nutritional status like anthropometry, clinical assessment, and biochemical assessment, etc.[1,2] In anthropometry body mass index (BMI) is an important measure which is calculated after taking height and weight of the person by formula (weight in kg/height in square meter and classified according to International WHO clasification.[2,3] Skin fold thickness is measured using Harpenden's calliper at 4 different sites biceps, triceps, sub scapular, suprailiac and cut offs are devised either for individual sites or for Total skin fold thickness.[4,5,6]

We wondered whether which site among skin fold thickness correlates significantly with BMI status of a

person. Taking this research question in mind we undertook a study to find out the correlation between BMI and skin fold thickness of biceps and triceps and whether that correlation stands true for both males and females.

METHODS

A cross sectional study was conducted in private medical college in Pune among 2nd year MBBS students after obtaining permission from institutional ethics committee. purposive sampling method was used and 24 students, who consented to participate, were included in the study. Two students were excluded as they did not show willingness for participation in the study. The written informed consent was taken from each of the study participant. The study was conducted over a period of 2 months from November to December 2018 and the study information was gathered using a semi structured proforma.

Anthropometric characteristics were measured in accordance with World Health Organization recommendations.[7] Height (cm) was measured using an easy-care stature meter and weight (kg) using an Eagele mechanical personal scale; students were bare-footed and wore light clothing. triceps, biceps skin folds (mm) were measured using a Harpenden's calliper on the right-hand side of the body. The skin fold was grasped firmly by the thumb and index finger; the Harpenden's calliper was placed perpendicular to the fold approximately 1 cm from the thumb and finger. The dial was read to the nearest 0.1 mm approximately five seconds after releasing the grip. Two measures were taken at each site. If a repeated measure varied by more than 1 mm, a third measure was taken.[8] BMI (weight in kg/height in meter^2) was calculated.

Statistical analysis

Data was analysed using Microsoft Excel and Prism version 5.0. The descriptive analysis involved calculating the mean and standard deviation. To analyse the correlation between BMI and biceps and triceps skin fold measurements, the spearman's correlation approach was followed and scatter plots were produced.

RESULTS

Among all study participants mean weight was 59.29±12.59 kg, mean height was 164.77±10.28 cm, mean BMI was 21.68±3.18 kg/m^2, mean biceps skin fold thickness was 7.20±2.68 mm and mean triceps skin fold thickness was 10.75±3.33 mm (Table 1).

Of all the study participants 4 (16.67%) were underweight, 15 (62.50%) were normal and 5 (20.83%) were pre-obese, none of the participants was obese (Table 2).

In our study we found that for complete sample i.e. 24, BMI correlates significantly with triceps skin fold thickness Spearman's r=0.53, p=0.006 as compared to biceps skin fold thickness Spearman's r=0.36, p=0.07 (Figure 1). Among males BMI correlates significantly with triceps skin fold thickness Spearman's r=0.64, p=0.01 as compared to biceps skin fold thickness Spearman's r=0.49, p=0.07 (Figure 2). Among females no significant correlation was found between BMI and biceps skin fold thickness Spearman's r=0.38, p=0.26 and triceps skin fold thickness Spearman's r=0.54, p=0.10 (Figure 3 and Table 3).

Table 1: Mean values, standard deviation of height, weight, BMI and biceps and triceps skin fold thicknesses in study participants.

Anthropometric Parameter	Males (n=14)		Females (n=10)		All (n=24)	
	Mean	S.D.	Mean	S.D.	Mean	S.D.
Height in cm	170.57	8.50	156.65	6.33	164.77	10.28
Weight in kg	64.85	12.87	51.50	7.09	59.29	12.59
BMI (kg/m^2)	22.21	3.66	20.95	2.35	21.68	3.18
Biceps skin fold thickness in mm	6.71	2.16	7.90	3.28	7.20	2.68
Triceps skin fold thickness in mm	10.21	3.30	11.50	3.40	10.75	3.33

Table 2: Body mass index of study participants.

Body mass index (kg/m^2)	Male (n=14)	Female (n=10)	Total (n=24)
Underweight (<18.49)	2	2	4
Normal (18.50-24.99)	8	7	15
Pre-obese (25-29.99)	4	1	5
Obese class 1 (30-34.99)	0	0	0
Obese class 2 (35-39.99)	0	0	0
Obese class 3 (>40)	0	0	0

Table 3: Correlation statistics.

BMI	Biceps skin fold thickness		Triceps skin fold thickness	
	Spearman's r	P value	Spearman's r	P value
Total (n=24)	0.36	0.07	0.53	0.006
Male (n=14)	0.49	0.07	0.64	0.01
Female (n=10)	0.38	0.26	0.54	0.10

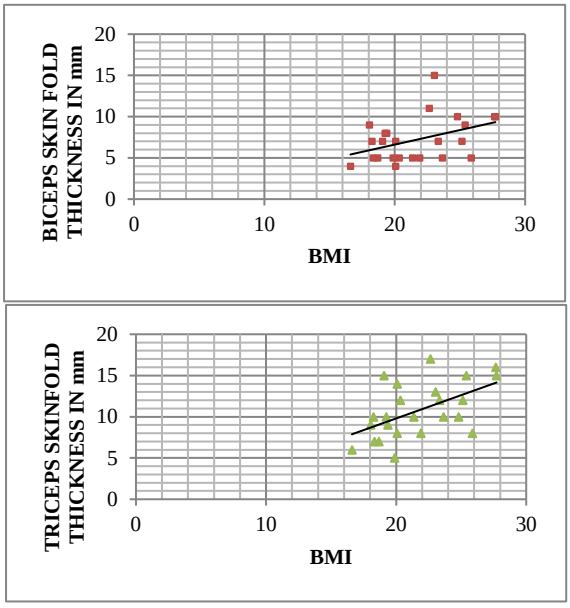

Figure 1: Scatter plots explaining correlation of BMI with biceps and triceps skin fold thickness in all study participants.

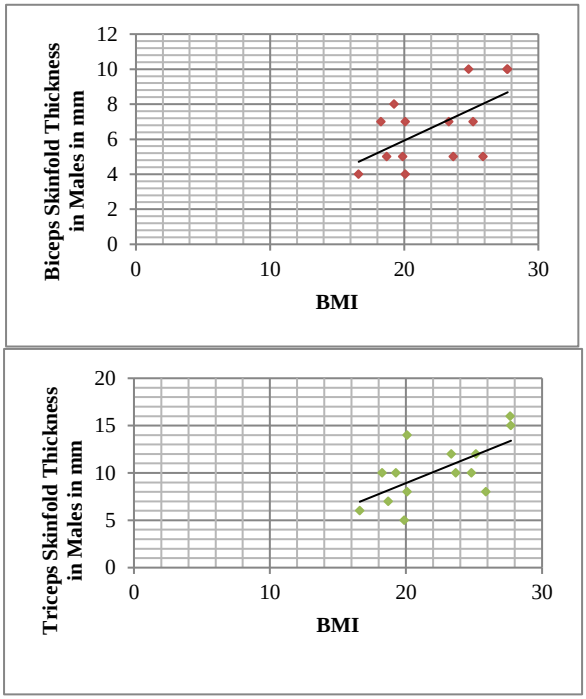

Figure 2: Scatter plots explaining correlation of BMI with biceps and triceps skin fold thickness in male study participants.

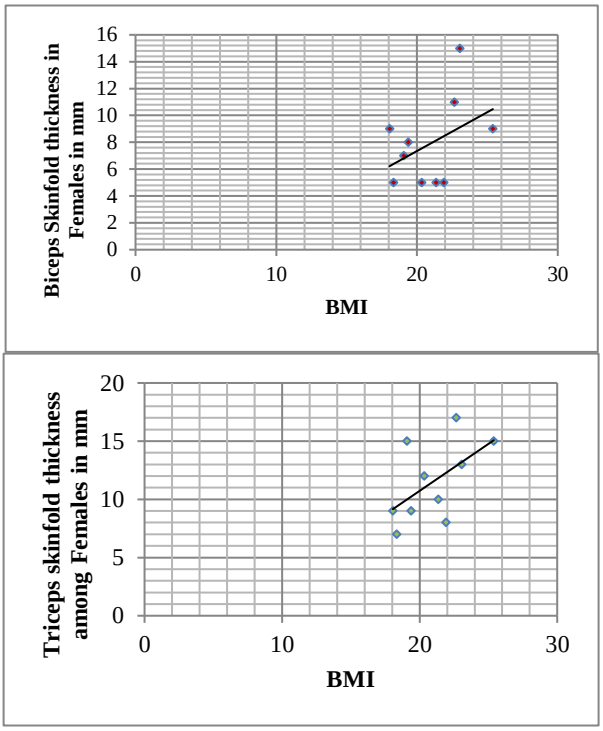

Figure 3: Scatter plots explaining correlation of BMI with biceps and triceps skin fold thickness in female study participants.

DISCUSSION

In our study for operational feasibility only two sites biceps and triceps were selected as it's easy to take skin fold thickness from biceps and triceps than other two sites.

In our study majority of the participants were having normal BMI followed by pre-obese BMI and underweight BMI respectively this is in accordance with findings of various studies.[9-17] However, this finding is contrary to findings of Reddy et al and Deepa et al who found out higher prevalence of obesity i.e. 45-47%.[18,19] We found that in all study participants i.e. 24, BMI correlates significantly with triceps skin fold thickness Spearman's r=0.53, p=0.006 which is in accordance with studies done by Mehru et al, Khadilkar et al, Robert et al.[20-22] However, this finding is not consistent with findings of Rolland et al and Rona et al which showed weak correlation.[23,24]

Among males BMI correlates significantly with triceps skin fold thickness Spearman's r=0.64, p=0.01. This is in accordance with study done by Robert et al.[22] However, this finding is not consistent with study done by Khadilkar et al and Himes et al which showed better correlation of BMI with triceps skin fold among females.[21,25]

This study had a limitation that the findings cannot be generalized as it was done on a smaller sample but there is a scope of doing it on a larger sample.

CONCLUSION

Our study findings highlighted that BMI correlates significantly with triceps skin fold thickness as compared to Biceps skin fold thickness in general. Significant correlation was found between BMI and triceps skin fold thickness among males but no significant correlation was found between BMI and biceps or triceps skin fold thickness among females.

ACKNOWLEDGEMENTS

We thank all the students who participated in this study.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

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Cite this article as: Chavhan SP, Chandrachood MV. Correlation of body mass index with biceps and triceps skin fold thickness. Int J Community Med Public Health 2020;7:1475-9.