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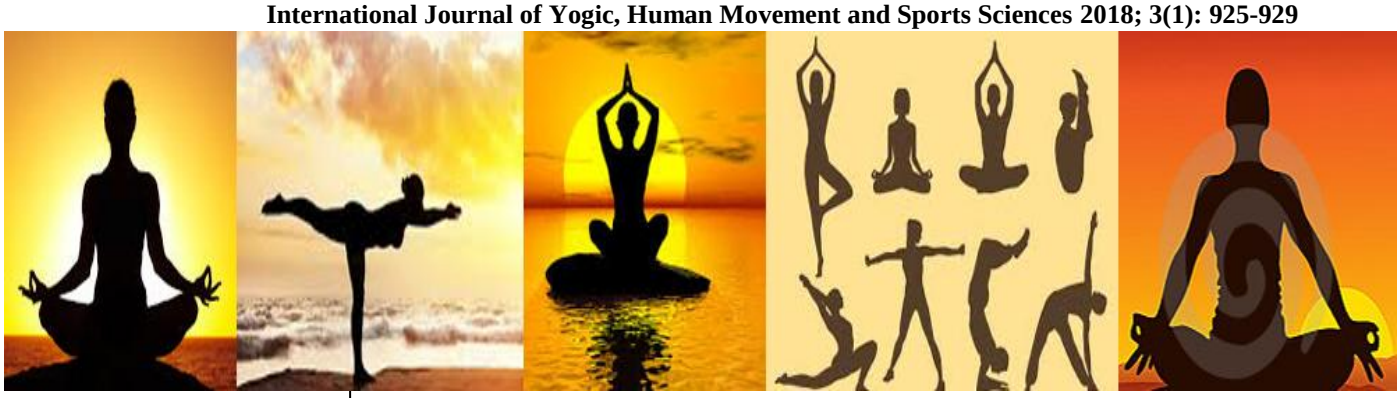

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Evaluation of anthropometric components in collegiate students of Bhopal, India: A comparative study

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Abstract
Background: Handgrip is a predictor of physical fitness, hand functions, and nutritional status. It is affected by many factors including age, sex, body mass index, and hand grip strength.
Aim: To compare anthropometric components in Collegiate Students.
Materials and Methods: This cross-sectional study included 105 students of both sexes (52 females and 53 males) selected from Rajeev Gandhi College, Bhopal, India using non-probability purposive sampling method. Their anthropometric parameters including height, weight, B.M.I. and hand grip strength were assessed using routine techniques. The handgrip was measured by using a handheld dynamometer. Hand preference was determined by asking which hand was used to write.
Results: The results were found to be significant.
Conclusion: There is significance as the male population was found to posses greater values as compared to the females.

Keywords: anthropometric, body mass index, dynamometer, handgrip, dominant, non-dominant

Introduction
Developing countries are witnessing a challenge of overweight and obesity in addition to persistent burden of under-nutrition [1]. Handgrip strength (HGS) is a reliable clinical parameter to assess nutritional status and physical fitness [2]. In addition to its use in evaluation of musculoskeletal and neuromuscular disorders [3, 4], It was used as a predictive factor of postoperative complications [5] risk of mortality in patients on hemodialysis[6] and critically ill patients [6]. Handgrip strength is "the maximal power of forceful voluntary flexion of all fingers under normal biokinetic conditions". Several factors were found to affect handgrip strength such as age, gender, muscle mass, body mass index, and hand dimensions [7].
Proper handgrip strength is essential for carrying precise hand functions such as gripping and pulling. It is considered a crucial factor in maximizing performance and control of many daily activities and sporting [8, 9] The relation between body mass index and handgrip strength is controversial. Some researchers found a positive relation while others reported partial positive or no significant relationship [10, 11].
Such discrepancy in results of studies about the relationship between body mass index and handgrip strength, in addition to scarcity of local studies on this issue in the students of Bhopal, India signify a research specific to Bhopal.
The aim of this study was to compare anthropometric components in Collegiate Students of Bhopal, India

Materials and Methods
This cross-sectional study was done at Rajeev Gandhi College, Bhopal, India during the period from 15th March 2017 to 20th January 2018. A convenient sample of 105 collegiate students of both sexes of age group 17- 23 years were chosen using non-probability purposive sampling method. Objectives of the study were explained to participants. They were assured that information obtained would be anonymous and confidential. Data were collected using a questionnaire designed for the purpose of the study. It included socio-demographic information (name, age and sex). Those who were involved in active muscle training exercises

and those who had a history of fracture in the past 3 months, a deformity, or pain at rest or movement in the upper arms were excluded.

Height was measured to the nearest centimetre using a stadiometer pole while the subject is in standing position without footwear and heals together. The weight was measured to the nearest 0.5 Kg, with light clothes and without footwear, by using a portable digital weighing scale. The body mass index (BMI) was calculated using Quetelet's index [12]. The handgrip strength in kilogram of the dominant hand was measured by using a handgrip dynamometer (Futaba Professional Hand Grip Dynamometer).

Measurement was done while the participant in standing position with shoulder adducted and neutrally rotated and elbow in full extension. The participants were asked to press the handle of the dynamometer with maximum strength. The maximal voluntary contraction was sustained for at least 5 seconds and it was recorded as the handgrip strength in kilograms (kg). Three readings were taken with a gap of 10 minutes and the maximum reading was taken for analysis [13].

The Ethical Committee of Rajeev Gandhi College, Bhopal approved the study. Each participant voluntarily provided written informed consent before participating. Statistical analysis was done using SPSS Version 23 (IBM Corp., Chicago, Illinois, USA). The results were presented in tables and graphs.

Results

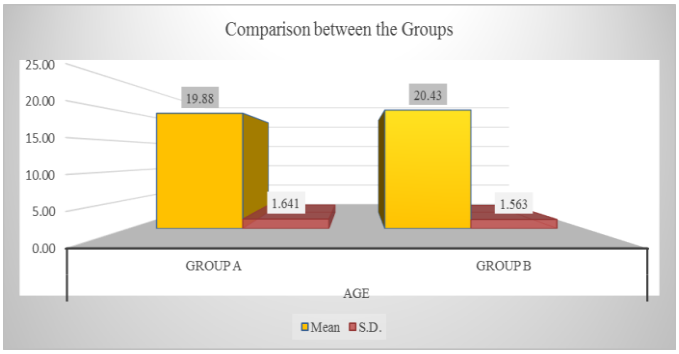
The Descriptive data of Age, Height, Weight, B.M.I. and Handgrip strength dominant and non-dominant hand has been tabulated in Table 1. There was significant difference between the groups regarding various variables in the study. (Tables 2 - 7).

Table 1: Descriptive Statistics

Descriptive Statistics	Mean	SD	N
Age	20.16	1.618	105
Height (mt)	1.60	0.139	105
Weight (Kg)	54.56	8.262	105
BMI	21.27	3.787	105
Hand Grip strength (Dominant hand) Kg	32.43	18.872	105
Hand Grip strength (Non-dominant hand)	30.92	18.103	105

Table 2: Summary of Age

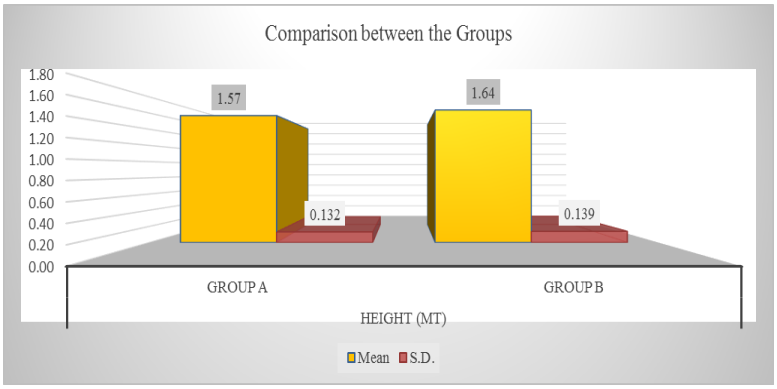
Unpaired T Test	Age	
	Group A	Group B
Mean	19.88	20.43
S.D.	1.641	1.563
Number	52	53
Maximum	23	23
Minimum	17	18
Range	6	5
Mean Difference	0.55	
Unpaired T Test	1.757	
P value	0.0819	
Table Value at 0.05 df 103	1.98	
Result	Not-Significant	



Graph 1: Graphical representation of Table 2

Table 3: Summary of Height (mt)

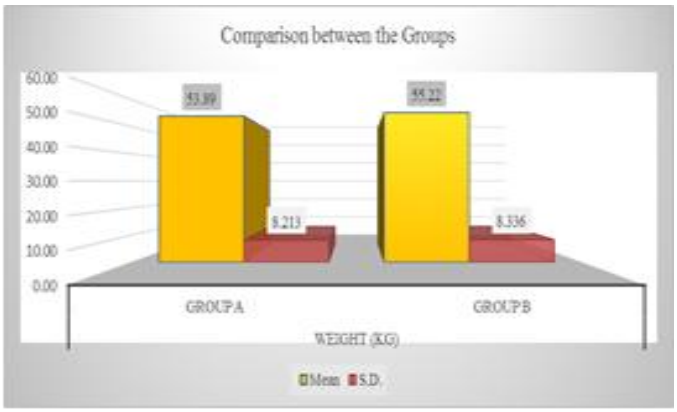
Unpaired T Test	Height (mt)	
	Group A	Group B
Mean	1.57	1.64
S.D.	0.132	0.139
Number	52	53
Maximum	1.81	1.81
Minimum	1.22	1.25
Range	0.59	0.56
Mean Difference	0.07	
Unpaired T Test	2.602	
P value	0.0107	
Table Value at 0.05 df 103	1.98	
Result	Significant	



Graph 2: Graphical representation of Table 3

Table 4: Summary of Weight (Kg)

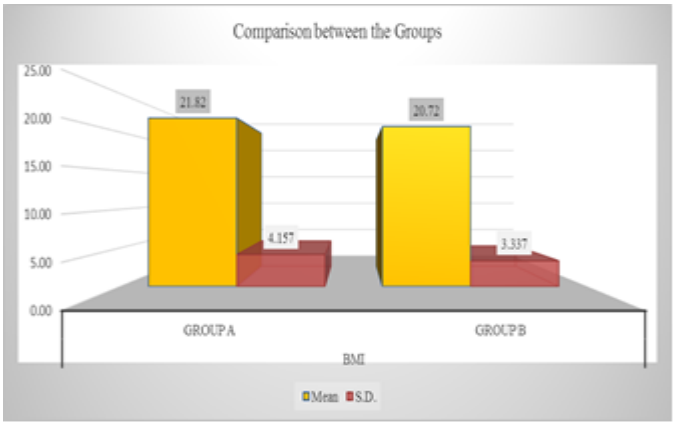
Unpaired T Test	Weight (Kg)	
	Group A	Group B
Mean	53.89	55.22
S.D.	8.213	8.336
Number	52	53
Maximum	77.5	72
Minimum	40.1	40
Range	37.4	32
Mean Difference	1.33	
Unpaired T Test	0.821	
P value	0.4134	
Table Value at 0.05 df 103	1.98	
Result	Not-Significant	



Graph 3: Graphical representation of Table

Table 5: Summary of Body Mass Index

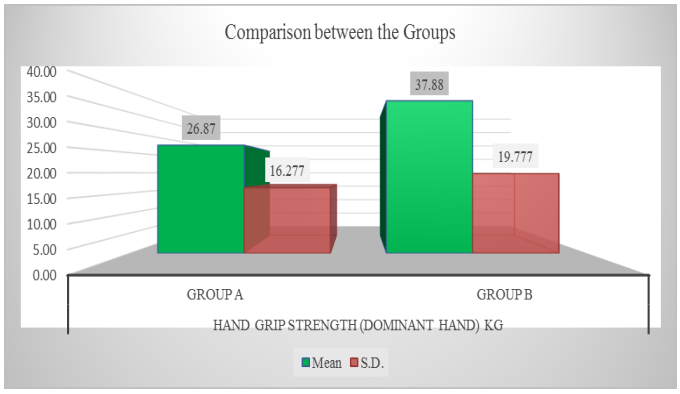
Unpaired T Test	BMI	
	Group A	Group B
Mean	21.82	20.72
S.D.	4.157	3.337
Number	52	53
Maximum	36.8	29.3
Minimum	16	15.4
Range	20.8	13.9
Mean Difference	1.10	
Unpaired T Test	1.492	
P value	0.1387	
Table Value at 0.05 df 103	1.98	
Result	Not-Significant	



Graph 4: Graphical representation of Table 5

Table 6: Summary of Hand Grip strength (dominant hand) Kg

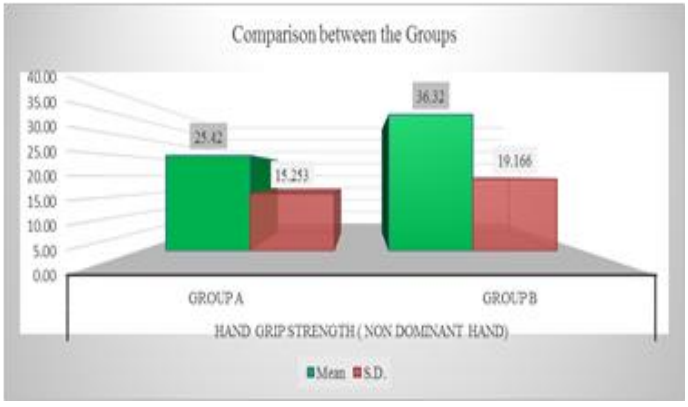
Unpaired T Test	Hand grip strength (dominant hand) Kg	
	Group A	Group B
Mean	26.87	37.88
S.D.	16.277	19.777
Number	52	53
Maximum	75	75
Minimum	4	4
Range	71	71
Mean Difference	11.02	
Unpaired T Test	3.115	
P value	0.0024	
Table Value at 0.05 df 103	1.98	
Result	Significant	



Graph 5: Graphical representation of Table 6

Table 7: Summary of Hand Grip strength (Non dominant hand)

Unpaired T Test	Hand grip strength (non dominant hand)	
	Group A	Group B
Mean	25.42	36.32
S.D.	15.253	19.166
Number	52	53
Maximum	82	91
Minimum	6	6
Range	76	85
Mean Difference	10.90	
Unpaired T Test	3.221	
P value	0.0017	
Table Value at 0.05 df 103	1.98	
Result	Significant	



Graph 6: Graphical representation of Table 7

Discussion

The mean handgrip strength of the students in Bhopal,India was 32.43±18.87 Kg and 30.92±18.10 Kg in dominant and non- dominant hand respectively but it was weaker than that reported for Western population [14, 15], suggesting that handgrip strength differs in different populations. Genetic factors and environmental factors such as socio-economic status and nutrition may contribute to such inter-population differences [16, 17].

In addition, differences in protocol and handgrip strength measures used in different studies may affect not only the precision and reproducibility of the measurements but also the ability to compare absolute values reported for grip strength between different study populations [17].

Sex wise, males showed a higher mean value for handgrip strength than females, a result that agrees with the study conducted by Koley and Singh.[18] and Men were found to possess greater strength for all muscles than women[19, 20] due to difference in muscle mass because of the male testosterone hormone which enlarges muscles and increases type II fibers with high activity of glycolytic enzymes [21-23]. Greater height leads to longer arms and greater lever arms resulting in an efficient force generation [24].

One limitation may be addressed in this study is that it was a cross-sectional study; therefore, a causal effect among variables is difficult to be identified.

Conclusion

The study found that gender and personal anthropometric variables; height, weight, hand grip strength and BMI has a significance as the male population was found to posses greater values as compared to the females .

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Conflicts of interest

There are no conflicts of interests.

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