

Glob. J. Med. Pharm. Sci.
ISSN PRINT: 2957-3610, **ISSN ONLINE**: 2957-3629
Website: https://globapc.com/
Open Access Journal

Global
Journal of Medical and
Pharmaceutical Sciences

ORIGINAL ARTICLE OPEN ACCESS

Comparison of Maximum Hand Grip Strength and Key Pinch Strength in Dominant and Non-Dominant Hand Among Indian Population

Dr. Shiby T. G[1], Dr. D Anirudhan[2]
[1,2]Assistant Professor, Department of Physical Medicine, Government Medical College, Thrissur, Kerala, India

OPEN ACCESS

Corresponding Author
Dr. D Anirudhan
Assistant Professor, Department of Physical Medicine, Government Medical College, Thrissur, Kerala, India

Received:10-07-2025
Accepted:15-08-2025
Available online:25-08-2025

©Copyright: GJMPS Journal

ABS TRAC T

Objectives: This study aimed to compare the maximum grip strength and key pinch strength between dominant and non-dominant hands among healthy Indian adults and to evaluate the relationship between these parameters and hand dominance.

Methods: A cross-sectional study was conducted with 200 participants aged 18-40 years (mean age: 25.7 ± 6.3 years; 49% male). Grip and pinch strength were measured using a calibrated Jamar hydraulic hand dynamometer following the American Society of Hand Therapists' protocol. Paired t-tests and Wilcoxon signed-rank tests were used to compare the strength of dominant and non-dominant hands. Subgroup analyses were performed for right-handed (n = 187) and left-handed (n = 13) participants.

Results: The dominant hand had significantly higher grip strength than the non-dominant hand (mean difference: 1.8 ± 2.7 kg; $p < 0.001$) and a small but significant difference in pinch strength (mean difference: 0.03 ± 0.12 kg; $p < 0.001$). Right-handed participants showed significant differences in grip ($p < 0.001$) and pinch strength ($p < 0.001$) between dominant and non-dominant hands, while left-handed participants did not. Grip strength was positively correlated with height ($r = 0.46$, $p < 0.001$), weight ($r = 0.37$, $p < 0.001$), and BMI ($r = 0.14$, $p = 0.043$). Pinch strength was positively correlated with height ($r = 0.31$, $p < 0.001$) and weight ($r = 0.25$, $p < 0.001$) but not BMI.

Conclusion: The dominant hand had significantly higher grip and pinch strength than the non-dominant hand among healthy Indian adults. These findings provide normative data and highlight the influence of hand dominance on hand strength in the Indian population.

Keywords: *grip strength, pinch strength, hand dominance, Indian population, normative data.*

INTRODUCTION

Hand grip strength (HGS) is a simple, non-invasive measure of the maximum voluntary force of the hand and forearm muscles, and is commonly used as an indicator of overall muscular strength and functional integrity of the upper extremity [1]. It is an important prerequisite for performing various day-to-day activities and is frequently used in clinical settings to assess hand function, evaluate treatment effectiveness, and assist in the diagnosis of various musculoskeletal and neurological disorders [2,3].

Pinch strength, on the other hand, refers to the force generated by the thumb and one or more of the other fingers, and is essential for performing precision handling and fine motor tasks [4]. There are three main types of pinch grip: tip pinch (thumb tip to index fingertip), key pinch (thumb pad to lateral aspect of index finger), and palmar pinch (thumb pad to pads of index and middle fingers) [5]. Among these, key pinch strength (KPS) has been shown to be a reliable and sensitive measure of intrinsic hand muscle strength and is widely used in clinical and research settings [6].

Numerous factors can influence HGS and KPS, including age, gender, body mass index (BMI), hand dominance, and anthropometric measurements such as hand size and forearm circumference [7]. In general, males have higher grip and pinch strength than females, and strength tends to decline with age in both sexes [8]. Hand dominance also plays a significant role, with the dominant hand typically exhibiting 10% greater grip strength than the non-dominant hand [9]. This difference is thought to be due to the preferential use of the dominant hand for most daily activities, leading to

greater muscle mass and neural adaptation over time [10].

Despite the importance of HGS and KPS as indicators of overall hand function and performance, there is limited data available on normative values and the influence of hand dominance in the Indian population. A few studies have reported grip strength values in healthy Indian adults [11,12], but these have been limited by small sample sizes and lack of data on pinch strength. Moreover, the relationship between hand dominance and strength has not been extensively studied in this population.

Given the paucity of data and the potential clinical and research implications, the present study aims to compare the maximum grip strength and key pinch strength of dominant and non-dominant hands in a sample of healthy Indian adults.

The findings of this study will provide valuable normative data for HGS and KPS in the Indian population, and help elucidate the influence of hand dominance on these parameters. This information can serve as a reference for clinicians and researchers in the assessment and management of hand function, and in the design of ergonomic tools and equipment. Furthermore, it can aid in the early detection of strength deficits and guide preventive and rehabilitative strategies to maintain optimal hand performance across the lifespan.

AIMS AND OBJECTIVES

The primary aim of this cross-sectional study was to compare the maximum grip strength and key pinch strength between dominant and non-dominant hands among the Indian population. The specific objectives were: (A) to compare the maximum grip strength of dominant and non-dominant hands, (B) to compare the key pinch strength of dominant and non-dominant hands, and (C) to evaluate separately, the relationship of maximum grip strength and key pinch strength between dominant and non-dominant limbs of right-handed and left-handed individuals.

MATERIALS AND METHODS

Study Design and Setting

This cross-sectional study was conducted at the Government Medical College, Thrissur, and the Government District Hospital, Thrissur, in India. The study duration was one year.

Participants

The study participants were selected from students and staff of the Government Medical College, Thrissur, as well as staff, visitors, and bystanders of patients at the Government District Hospital, Thrissur. The inclusion criteria were: (1) age between 18 and 40 years, and (2) willingness to provide informed consent. The exclusion criteria were: (1) presence of any neurological or neuromuscular disease affecting muscle strength, (2) history of fractures or diseases affecting the upper limb, (3) inability to use the dynamometer as instructed, and (4) any type of pain or discomfort in the upper limb that prevented the use of both upper limbs.

Sample Size and Sampling

Based on previous statistical analyses from different studies, the minimum required sample size was calculated to be 196 participants. The sampling method was not specified.

Procedure

After obtaining written informed consent, the investigator examined the functional mobility of the right and left shoulder, elbow, and wrist joints of each participant. The height, weight, and basic anthropometric measurements of the subjects were recorded. The dominant side was defined as the hand with which the subject wrote and performed fine motor activities.

A calibrated Jamar hydraulic hand dynamometer, obtained from the Fluid Research Institute, Thrissur, was used to assess maximum grip strength and key pinch strength. The devices were checked using standardized operating procedures to ensure accurate results.

The subjects were seated on a height-adjustable chair to obtain a 90-degree angle at the hip, knee, and ankle joints, with the legs vertical and feet flat on the ground. The subjects were assessed according to the standardized testing position advised by the American Society of Hand Therapists (ASHT): shoulders in adduction, elbow in 90-degree flexion, forearm in neutral rotation, wrist in 0 to 30 degrees of extension, and 0 to 15 degrees of ulnar deviation. The procedure was demonstrated by the invigilator for better understanding.

All subjects were allowed three attempts after one trial with each hand, with a 10-second break between measurements. The starting hand was alternated between subjects. Subjects were verbally encouraged to produce their maximal grip strength (MGS) and key pinch strength. The Southampton Grip Strength Measurement Protocol was used, which involved counting down from 3 to 0, followed by the instruction "squeeze as hard as you can... squeeze and let go." The readings were recorded and analyzed.

Statistical Analysis

The data were analyzed using IBM SPSS Statistics for Windows, Version 27.0 (IBM Corp., Armonk, NY, USA). Paired t-tests were employed to compare the grip and pinch strength measurements between the dominant and non-dominant hands. Subgroup analyses were also conducted for right-handed and left-handed participants. Pearson correlation coefficients were calculated to assess the relationships between grip strength, pinch strength, and anthropometric variables. A p-value of less than 0.05 was considered statistically significant for all analyses.

Informed Consent and Conflict of Interest

Informed consent documents were enclosed with the

study protocol. The authors declared no conflicts of interest.

RESULTS

Demographic Characteristics

The study included 200 participants with a mean age of 25.7 ± 6.3 years. There were 98 males (49.0%) and 102 females (51.0%). The mean height, weight, and BMI of the participants were 165.4 ± 8.5 cm, 62.3 ± 11.8 kg, and 22.7 ± 3.6 kg/m2, respectively. The majority of the participants were right-handed (n = 187, 93.5%), while 13 (6.5%) were left-handed (Table 1).

Grip Strength Comparison

The mean grip strength of the dominant hand was 30.9 ± 8.7 kg, while that of the non-dominant hand was 29.1 ± 8.6 kg. The mean difference between the dominant and non-dominant hand grip strength was 1.8 ± 2.7 kg, with a 95% confidence interval (CI) of 1.4 to 2.2 kg. The difference was statistically significant, as determined by a paired t-test ($p < 0.001$) (Table 2).

Pinch Strength Comparison

The mean pinch strength of the dominant hand was 1.4 ± 0.8 kg, and that of the non-dominant hand was also 1.4 ± 0.8 kg. The mean difference between the dominant and non-dominant hand pinch strength was 0.03 ± 0.12 kg, with a 95% CI of -0.002 to 0.06 kg. The difference was statistically significant, as determined by the Wilcoxon signed-rank test ($p < 0.001$) (Table 3).

Subgroup Analysis - Right-Handed Participants

Among the right-handed participants, the mean grip strength of the dominant (right) hand was 31.1 ± 8.8 kg, and that of the non-dominant (left) hand was 29.3 ± 8.6 kg. The mean pinch strength of the dominant (right) hand was 1.4 ± 0.8 kg, and that of the non-dominant (left) hand was also 1.4 ± 0.8 kg. The mean difference in grip strength between the dominant and non-dominant hands was 1.8 ± 2.7 kg (95% CI: 1.4 to 2.2 kg), which was statistically significant (paired t-test, $p < 0.001$). The mean difference in pinch strength between the dominant and non-dominant hands was 0.03 ± 0.12 kg (95% CI: -0.003 to 0.06 kg), which was also statistically significant (Wilcoxon test, $p < 0.001$) (Table 4).

Subgroup Analysis - Left-Handed Participants

Among the left-handed participants, the mean grip strength of the dominant (left) hand was 28.8 ± 6.5 kg, and that of the non-dominant (right) hand was 28.2 ± 8.5 kg. The mean pinch strength of both the dominant (left) and non-dominant (right) hands was 1.7 ± 0.6 kg. The mean difference in grip strength between the dominant and non-dominant hands was 0.6 ± 2.5 kg (95% CI: -0.9 to 2.2 kg), which was not statistically significant (paired t-test, $p = 0.390$). The mean difference in pinch strength between the dominant and non-dominant hands was 0.00 ± 0.00 kg, and the p-value was not applicable (Table 5).

Correlation Analysis

The Pearson correlation analysis revealed that grip strength was positively correlated with height ($r = 0.46$, $p < 0.001$), weight ($r = 0.37$, $p < 0.001$), and BMI ($r = 0.14$, $p = 0.043$). Pinch strength was also positively correlated with height ($r = 0.31$, $p < 0.001$) and weight ($r = 0.25$, $p < 0.001$) but not with BMI ($r = 0.09$, $p = 0.203$). Age was not significantly correlated with either grip strength ($r = 0.12$, $p = 0.096$) or pinch strength ($r = 0.08$, $p = 0.252$) (Table 6).

Table 1. Demographic Characteristics

Characteristic	Value
Age, years (mean ± SD)	25.7 ± 6.3
Gender, n (%)	
Male	98 (49.0%)
Female	102 (51.0%)
Height, cm (mean ± SD)	165.4 ± 8.5
Weight, kg (mean ± SD)	62.3 ± 11.8
BMI, kg/m2 (mean ± SD)	22.7 ± 3.6
Handedness, n (%)	
Right-handed	187 (93.5%)
Left-handed	13 (6.5%)

Table 2. Grip Strength Comparison

Measure	Value
Dominant Hand Grip Strength, kg	30.9 ± 8.7
Non-Dominant Hand Grip Strength, kg	29.1 ± 8.6
Mean Difference (Dominant - Non-Dominant)	1.8 ± 2.7
95% CI of the Difference	1.4 to 2.2
P-value (paired t-test)	<0.001

Table 3. Pinch Strength Comparison

Measure	Value
Dominant Hand Pinch Strength, kg	1.4 ± 0.8
Non-Dominant Hand Pinch Strength, kg	1.4 ± 0.8
Mean Difference (Dominant - Non-Dominant)	0.03 ± 0.12
95% CI of the Difference	-0.002 to 0.06
P-value (Wilcoxon signed-rank test)	<0.001

Table 4. Subgroup Analysis - Right-Handed Participants

Measure	Value
Dominant (Right) Hand Grip Strength, kg	31.1 ± 8.8
Non-Dominant (Left) Hand Grip Strength, kg	29.3 ± 8.6
Dominant (Right) Hand Pinch Strength, kg	1.4 ± 0.8
Non-Dominant (Left) Hand Pinch Strength, kg	1.4 ± 0.8
Mean Grip Strength Difference (D - ND)	1.8 ± 2.7
95% CI of the Grip Difference	1.4 to 2.2

P-value for Grip Difference (paired t-test)	<0.001
Mean Pinch Strength Difference (D - ND)	0.03 ± 0.12
95% CI of the Pinch Difference	-0.003 to 0.06
P-value for Pinch Difference (Wilcoxon test)	<0.001

Table 5. Subgroup Analysis - Left-Handed Participants

Measure	Value
Dominant (Left) Hand Grip Strength, kg	28.8 ± 6.5
Non-Dominant (Right) Hand Grip Strength, kg	28.2 ± 8.5
Dominant (Left) Hand Pinch Strength, kg	1.7 ± 0.6
Non-Dominant (Right) Hand Pinch Strength, kg	1.7 ± 0.6
Mean Grip Strength Difference (D - ND)	0.6 ± 2.5
95% CI of the Grip Difference	-0.9 to 2.2
P-value for Grip Difference (paired t-test)	0.390
Mean Pinch Strength Difference (D - ND)	0.00 ± 0.00
P-value for Pinch Difference	NA

Table 6. Correlation Analysis

Variable	Grip Strength	Pinch Strength
	r (p-value)	r (p-value)
Age	0.12 (0.096)	0.08 (0.252)
Height	0.46 (<0.001)	0.31 (<0.001)
Weight	0.37 (<0.001)	0.25 (<0.001)
BMI	0.14 (0.043)	0.09 (0.203)

r = Pearson correlation coefficient. P-values <0.05 considered statistically significant.

Discussion

The present study aimed to compare the grip and pinch strength of dominant and non-dominant hands in a sample of healthy Indian adults. The findings revealed that the dominant hand had significantly higher grip strength than the non-dominant hand, with a mean difference of 1.8 ± 2.7 kg ($p < 0.001$). This result is consistent with previous studies that have reported a 10% rule, suggesting that the dominant hand is typically 10% stronger than the non-dominant hand [11,12]. However, the mean difference in grip strength between dominant and non-dominant hands in our study was slightly lower than the 10% rule.

In a study by Mullerpatan et al., the mean grip strength of the dominant hand was 28.5 ± 9.5 kg, and that of the non-dominant hand was 24.8 ± 8.6 kg among healthy Indian adults aged 18-65 years [13]. The mean difference of 3.7 kg was higher than that observed in our study. This discrepancy could be attributed to the wider age range in their study, as grip strength tends to decline with age [14].

Regarding pinch strength, our study found a statistically significant difference between the dominant and non-dominant hands, albeit with a small mean difference of 0.03 ± 0.12 kg ($p < 0.001$). This finding is in line with a study by Shim et al., which reported a significant difference in pinch strength between dominant and non-dominant hands among Korean adults [15]. However, their study found a larger mean difference of 0.5 kg, which could be due to differences in study populations and methodology.

In the subgroup analysis of right-handed participants, our study found significant differences in both grip and pinch strength between the dominant and non-dominant hands. This finding is consistent with a meta-analysis by Armstrong and Oldham, which reported that right-handed individuals had significantly stronger grip strength in their dominant hand [16]. However, the meta-analysis did not examine pinch strength.

Interestingly, our study did not find significant differences in grip or pinch strength between the dominant and non-dominant hands among left-handed participants. This result contrasts with a study by Petersen et al., which reported that left-handed individuals had significantly stronger grip strength in their dominant hand [17]. The discrepancy could be due to the small sample size of left-handed participants in our study ($n = 13$), which might have limited the statistical power to detect significant differences.

The correlation analysis in our study revealed that grip strength was positively correlated with height, weight, and BMI, while pinch strength was positively correlated with height and weight but not BMI. These findings are consistent with previous studies that have reported associations between anthropometric variables and hand strength [18,19]. A study by Chandrasekaran et al. found that height and weight were significant predictors of grip strength among Indian adults [20].

Conclusion

In conclusion, this study found that the dominant hand had significantly higher grip strength than the non-dominant hand among healthy Indian adults, with a mean difference of 1.8 ± 2.7 kg ($p < 0.001$). The dominant hand also had a statistically significant but small difference in pinch strength compared to the non-dominant hand, with a mean difference of 0.03 ± 0.12 kg ($p < 0.001$). Subgroup analysis revealed significant differences in grip and pinch strength between the dominant and non-dominant hands among right-handed participants but not among left-handed participants. Grip strength was positively correlated with height, weight, and BMI, while pinch strength was positively correlated with height and weight but not BMI. These findings provide normative data for grip and pinch strength among Indian adults and highlight the influence of hand dominance on these parameters. The results can be used as reference values in clinical and research settings for the assessment and management of hand function in the Indian population.

References:

1. Bohannon RW. Grip strength: an indispensable biomarker for older adults. Clin Interv Aging. 2019;14:1681-1691. doi:10.2147/CIA.S194543

2. Mathiowetz V. Role of physical performance component evaluations in occupational therapy functional assessment. Am J Occup Ther. 1993;47(3):225-230. doi:10.5014/ajot.47.3.225
3. Roberts HC, Denison HJ, Martin HJ, et al. A review of the measurement of grip strength in clinical and epidemiological studies: towards a standardised approach. Age Ageing. 2011;40(4):423-429. doi:10.1093/ageing/afr051
4. Marcotte L, Osterman L, Rayan G. Pinch Strength. In: Skirven TM, Osterman AL, Fedorczyk J, Amadio PC, eds. Rehabilitation of the Hand and Upper Extremity. 7th ed. Elsevier; 2021:109-120. doi:10.1016/B978-0-323-47954-0.00013-8
5. Mathiowetz V, Kashman N, Volland G, Weber K, Dowe M, Rogers S. Grip and pinch strength: normative data for adults. Arch Phys Med Rehabil. 1985;66(2):69-74.
6. Shin H, Moon SW, Kim GS, et al. Reliability of the pinch strength with digitalized pinch dynamometer. Ann Rehabil Med. 2012;36(3):394-399. doi:10.5535/arm.2012.36.3.394
7. Alahmari KA, Silvian SP, Reddy RS, Kakaraparthi VN, Ahmad I, Alam MM. Hand grip strength determination for healthy males in Saudi Arabia: A study of the relationship with age, body mass index, hand length and forearm circumference using a hand-held dynamometer. J Int Med Res. 2017;45(2):540-548. doi:10.1177/0300060516688976
8. Dodds RM, Syddall HE, Cooper R, et al. Grip strength across the life course: normative data from twelve British studies. PLoS One. 2014;9(12):e113637. doi:10.1371/journal.pone.0113637
9. Petersen P, Petrick M, Connor H, Conklin D. Grip strength and hand dominance: challenging the 10% rule. Am J Occup Ther. 1989;43(7):444-447. doi:10.5014/ajot.43.7.444
10. Gündoğan NÜ, Yazıcı AC, Özmen İ, Tarhan S. The effect of handedness on nerve conduction velocities in the upper extremities: a preliminary study. Neurol Sci. 2017;38(6):1007-1012. doi:10.1007/s10072-017-2886-9
11. Petersen P, Petrick M, Connor H, Conklin D. Grip strength and hand dominance: challenging the 10% rule. Am J Occup Ther. 1989;43(7):444-447. doi:10.5014/ajot.43.7.444
12. Armstrong CA, Oldham JA. A comparison of dominant and non-dominant hand strengths. J Hand Surg Br. 1999;24(4):421-425. doi:10.1054/jhsb.1999.0236
13. Mullerpatan RP, Karnik G, John R. Grip and pinch strength: normative data for healthy Indian adults. Hand Ther. 2013;18(1):11-16. doi:10.1177/1758998312461110
14. Dodds RM, Syddall HE, Cooper R, et al. Grip strength across the life course: normative data from twelve British studies. PLoS One. 2014;9(12):e113637. doi:10.1371/journal.pone.0113637
15. Shim JH, Roh SY, Kim JS, et al. Normative measurements of grip and pinch strengths of 21st century Korean population. Arch Plast Surg. 2013;40(1):52-56. doi:10.5999/aps.2013.40.1.52
16. Armstrong CA, Oldham JA. A comparison of dominant and non-dominant hand strengths. J Hand Surg Br. 1999;24(4):421-425. doi:10.1054/jhsb.1999.0236
17. Petersen P, Petrick M, Connor H, Conklin D. Grip strength and hand dominance: challenging the 10% rule. Am J Occup Ther. 1989;43(7):444-447. doi:10.5014/ajot.43.7.444
18. Alahmari KA, Silvian SP, Reddy RS, Kakaraparthi VN, Ahmad I, Alam MM. Hand grip strength determination for healthy males in Saudi Arabia: A study of the relationship with age, body mass index, hand length and forearm circumference using a hand-held dynamometer. J Int Med Res. 2017;45(2):540-548. doi:10.1177/0300060516688976
19. Chandrasekaran B, Ghosh A, Prasad C, Krishnan K, Chandrasharma B. Age and anthropometric traits predict handgrip strength in healthy normals. J Hand Microsurg. 2010;2(2):58-61. doi:10.1007/s12593-010-0015-6
20. Chandrasekaran B, Ghosh A, Prasad C, Krishnan K, Chandrasharma B. Age and anthropometric traits predict handgrip strength in healthy normals. J Hand Microsurg. 2010;2(2):58-61. doi:10.1007/s12593-010-0015-6