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# A Study on Grip and Pinch Strength in Healthy Indian Adult Population

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**Abstract:** *Hand is an important component of the human body which performs numerous tasks. The hand grip strength has been described as the power of the combined contraction of the extrinsic and intrinsic muscle of the hand that flexes joints of the hand. Measurement of handgrip strength is an important component for hand rehabilitation. It assesses the patient's initial limitations and provides a quick assessment of the patient's progress throughout the treatment. The power grip is the result of forceful flexion of all the joints of the fingers with maximal voluntary contraction of the hand that the subject is able to exert under normal bio kinetic condition. Normative data provide a reliable method in clinical evaluation of the impact from several injuries to either the musculoskeletal or the neurological system of the hand. Moreover, normal data have a major role in assessing the effectiveness of a surgical procedure and offer a clinical approach for patient follow-up. This research paper is the outcome of an empirical study conducted on testing of Grip and Pinch strength in Indian context. The aim of this paper is to present the methodology and result of the study along with analytical expression. The study intended to measure normative value of hand grip strength and pinch grip strength for the Indian population from all four zones of India with age group cohort of 18-80 years. For measuring pinch strength the gauge was placed between the thumb pad and the radial side of the middle phalanx of the index finger and the rest of the procedure was the same. This study investigated the normal hand grip and pinch grip in a normal healthy Indian population. 600 healthy subjects with an age cohort of 18-40, 41-60 and 61 above were taken*

**Keywords:** Healthy, Subject, Grip, Pinch, Measurement, Dynamometer, Treatment, Surgery



## INTRODUCTION

The present study is based on the grip and pinch strength of human beings so the subject matter of the hand aspect is the focus point. Hand is an important component of the human body which performs numerous tasks. The hand grip strength has been described as the power of the combined contraction of the extrinsic and intrinsic muscle of the hand that flexes joints of the hand. Measurement of handgrip strength is an important component for hand rehabilitation. It assesses the patient's initial limitations and provides a quick assessment of the patient's progress throughout the treatment. The power grip is the result of forceful flexion of all the joints of the fingers with maximal voluntary contraction of the hand that the subject is able to exert under normal bio kinetic condition. The function of the hand intricately involves motion, strength, dexterity and motivation. Many daily activities involve interaction with objects that are grasped in the hand. The manipulative ability of the human hand requires effective force (Bansal-2008). The thumb's ability to swing widely from the palm lends to the hands ordinary versatility, furthermore, the ability to oppose each of the four digits with an equal force provides a structural basis for coordination. The thumb when used acts as a stabilizer to the object held between the fingers and the palm. An individual's ability to grip and manipulate objects is affected by many factors including hand strength, sensory motor impairment and frictional coupling between the hand and the object. In a sense, the wrist is simply a mechanical device, which contributes to the usefulness of the hand, which increases the variety of positions where the hand may be used. In fact, all the joints of the upper extremity may be viewed as servants of the hand (Scot-1987). Therefore, the hand and the brain form an inseparable interacting functional pair and their close interaction is responsible for man's ability to alter nature at his will and dominate other species. (Kapandji- 1995). The therapist with any amount of experience in hand rehabilitation knows that patients with adequate strength may not be coordinated enough to accomplish simple tasks, and that patients with poor range of motion and severe deformity may have both the strength and coordination to accomplish a complex task. The function of the hand intricately involves motion, strength, dexterity and motivation (Scot-1987).

### Study background

Power grip possesses the following sequence, like opening of the hand, positioning of fingers, approaching the fingers to the object, maintaining a static phase that actually constitutes the grip. Metacarpo Phalangeal flexors, abductors and adductors i.e. interossei helps in strong grip as same as extrinsic flexors. Extensor Digitorum increases the joint compression and enhances the joint stability. Muscles of the hypothenar eminence that are Abductor digiti minimi, Opponens digiti minimi, Flexor digiti minimi are responsible for an active cylindrical grip.(Pamela- 2001). Power grip is commonly used as an index to assess impairment and treatment outcome of hand

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function. Analysis of grip strength is an important index of hand rehabilitation programmes because it assesses the patient's initial limitation and can be compared with normal. Measurement of handgrip strength's utility continues throughout the treatment process because it provides a quick reassessment.( Peterson et al- 1989).

Grip strength testing has been used in a variety of clinical areas and for multiple purposes, such as: The assessment of the upper limb impairment (Blair et al- 1987). There are numerous methods of assessing handgrip strength, which involves a diverse range of assessment protocols, testing positions and instruments used. The selection of these parameters should be very much appropriate and that should be considered with respect to the purpose of assessment.(Innes.- 1999). A wide range of instruments are available to measure the grip strength and most of them fall broadly in four categories: Hydraulic instrument.(e.g. Jamar dynamometer) Pneumatic instrument.(e.g. Modified Sphygmomanometer)Strain gauges.(e.g. Isometric Strength Testing Unit)Mechanical instrument.(e.g. Smedley dynamometer). But out of these four, Jamar Dynamometer is the most widely reported and recommended instrument to measure grip strength. (Mathiowetz-1991).

A survey in the USA found that almost 80% therapists use Jamar Dynamometer for measuring hand grip strength. It was found that the Jamar dynamometer achieved the highest calibration accuracy of + 3%, and ICC = 0.9994. (Fess-1987). Most of the studies have used the standard testing position approved by American Society of Hand Therapist (ASHT) 1992 (Desrosiers et al – 1995). The measurement is being done with certain methods. "With subjects in sitting position, feet flat on the ground with shoulder fully adducted and in neutral rotation, elbow in 90$^{o}$ of flexion, wrist in 10$^{o}$ – 20$^{o}$ of extension with slight ulnar deviation and forearm in mid prone with mild ulnar deviation of the wrist", which is also called the functional position of the hand. Although a minimum of only 20lb (9kg) is essential for performing basic daily activities (Mathiowetz V, et al.- 1985). Most therapists set a higher goal to help their patients to achieve a greater overall improvement in function. In recent times many studies have attempted to provide a picture of the difference between dominant and non-dominant handgrip strength. It has been proved earlier that the population as whole demonstrated a significant difference between their dominant and non dominant handgrip strength. Therapists often follow the 10% rule as general guidelines (Bechtol-1954). This rule states that a person's grip strength in the dominant hand is 10% greater than that of a non dominant hand. For example the grip strength goal for a person with an injured right (dominant) hand, whose left (non-dominant) hand grip strength is 50kg, should be 55kg, excluding adjustment for the extent of the injury and other variants (Bansal- 2008).

The 10% rule dates back to 1954 when Bechtol observed that most of the patients resented a difference of 5% to 10% between their dominant and non-dominant hands on grip strength measurements, the dominant hand was found stronger. Several studies have since then been conducted to establish normative data for grip strength measurements to be used as treatment guidelines. However these studies did not address right and left hand grip strength differences in relation hand dominance (Bechtol- 1954). In the present climate of clinical and cost effectiveness rehabilitation clinicians must set outcome goals for their treatment. In the field of hand rehabilitation, the most frequently used goal by the therapist for the patient is to return to pre-injury or pre-illness status of the hand function. Many treatment protocols compare the strength of the injured limb with that of the uninjured limb. This is useful when the pre-injury strength is similar in both the limbs. Problem arises however when it is not the case, for example when comparing the hand strength, keeping this in view predicting pre-injury muscle strength presents certain problems.

Hand grip strength is an easily obtainable measure of physical health and muscle function. It has been used by human ecologists to study development in children (Andrew- 2007) by surgeon's to predict post-operative complications (. Mathiowetz-1985), by epidemiologist and gerontologists to study the effects of aging in human population (Andrew C- 2007) Reduced manual dexterity occurs in many healthy elderly persons, often affecting their quality of life and capacity for independent living (Kelly J. etal- 1999)

The evaluation of grip strength is of crucial importance in the assessment of upper limb impairment, it determines the handedness of an individual , it is often used as an indicator of the overall physical strength , hand and forearm muscles performances and as a functional index of

nutritional status falls and fractures. The grip strength provides an objective index of the functional integrity of the upper extremity. It is a variable that is affected by a number of factors including age, gender, body size and socioeconomic status (Shyamal- 2010).

The power of hand grip is the result of forceful flexion of all fingers, with the maximum voluntary force that the subject is able to exert under normal biokinetics conditions which uses several muscles in the hands and the forearm. The estimation of hand grip strength is of immense importance in determining the efficacy of different treatment strategies of the hand and also in hand rehabilitation in decision making in hand surgery to interpret evaluation data, to set realistic treatment goals and to assess a patient's ability to return to employment (Mathiowetz- 1985). In case of impaired hand functions due to brain lesions, peripheral neuropathies or other causes, it is imperative that hand strength be evaluated in order to determine the severity of hand dysfunction and establish an effective rehabilitation programme. The grip strength was documented to be higher in subjects with right hand dominance but no significant differences between sides could be documented for left hand dominant subjects. The power grip is a forceful act resulting in flexion of all finger joints. Power grip is commonly used as an index to assess impairment and treatment outcome of hand function (Talsania- 1998).

Analysis of grip strength is an important index of hand rehabilitation programmes because it assesses the patient's initial limitation and can be compared with normal. Measurement of hand grip strength's utility continues throughout the treatment process because it provides a quick reassessment. Normative data is needed to interpret evaluation of data in order to establish realistic treatment of data in order to establish realistic treatment goals and ultimately determine if therapeutic outcomes result in normal or impaired hand strength. It is particularly necessary to have accurate norms for grip strength for aged individuals, who compromise large percentages of patients seen in rehabilitation programs (Peterson- 1998).

**Objectives of the study**

In order to study the pinch and grip strength of human beings, the scholar has taken the following objectives.

- To know information on hand grip and pinch grip of normal healthy individuals from different studies of the recent past.
- To gather information on the actual grip and pinch strength from the selected respondents from the study area.
- To present different modes of testing procedure for grip and pinch and the consequences of testing.

## METHODOLOGY

Subjects (respondents) were selected from the four geographical zones of the country (east, west, north, south, and each city representing each zone) based on a cluster sampling. In every zone 150 participants have been taken including males and females. Total number of participants chosen from all the four zones is 600. The inclusion criteria has been fixed for Healthy individuals between the age limit of 18-60years and above. The exclusion criteria has been fixed that i) recent injury of upper limb within 6 months; ii) disease involving the upper extremity distal to shoulder; iii) acute pain of the extremity distal the shoulder, less than 6 months post-hospitalization because of relevant surgery and iv) subjects with dysfunction of elbow joint were also excluded. Consent was taken from all the individual participants who met the inclusion criteria of the study. A sample of 600 samples were recruited for study, who came under the inclusion criteria.

Hand Held Dynamometer (Jamar Dynamometer): The hydraulic sealed instrument (Baseline Inc. U.S.A) was used in this study, which records static handgrip strength in kilograms or pounds of force. The handles, which can be adjusted to five different positions (2.5, 3.8, 5.1, 6.4, and 7.6 cms apart) for better grip and recording. These five settings place the fingers in different levels of extension. It has been proved that hands had maximal grip strength when the dynamometer was at setting II (3.8 apart) (Firrell- 1996). This device is the most widely reported and recommended measure of grip strength and appears to be the most widely used. Mathiowetz et al found that the Jamar dynamometer achieved the highest calibration accuracy of + 3%, and ICC = 0.9994 (Mathiowetz e tal – 1984) and (Fess- 1987). B & L pinch gauge was used in this study to record static pinch grip strength in kilograms or pounds of force. It is a valid and reliable tool for measuring pinch grip.

Each participant received written information about aims and importance of the study and they were asked to sign the consent form if they were willing to participate in study. They were assured that personal details given by them will not be disclosed to any public accesses. All participants who gave their consent to take part were informed that they are free to withdraw from the study at any time.

**Procedure of testing**

To get the maximum reliability of the data collected, every subject was asked to squeeze the dynamometer and the pinch gauge thrice. The mean of these three trials were taken as the readings.[44]The trials were taken at a rest period of 60 seconds and mean of three trials were considered in this study. Three attempts for each subject were conducted, alternating right and left hands with one minute of rest between two successive trials to overcome the fatigue. The same researcher read the dynamometer dial to record the various attempts. The dynamometer and pinch gauge were reset to zero prior to each reading of grip strength and pinch strength and it was read to the nearest increment of two. Subjects were asked to give maximum effort. The grip strength and pinch strength reading for each subject was recorded and was tabulated in the measurement tool. All the recordings were entered in the master sheet with pencil prior to the data analysis. The mean of hand grip strength of left hand and right hand, mean of pinch grip strength of right hand and left hand, weight, height, BMI, geographical zones (east, west, north,south) have been recorded.

**Data Analysis**

**1.** ARITHMETIC MEAN

$$\overline{X} = \frac{\sum X}{N}$$

Where, $\overline{X}$ = Arithmetic Mean

$\sum x$ = Sum of the variable

N = The total number of variables.

**2.** STANDARD DEVIATION (S.D)

$$S.D = \sqrt{\frac{\sum (x - x)^2}{N}}$$

Where, x = the individual score

$\overline{X}$ = the mean score

N = the total number of scores.

3. ANOVA

$$\sum_i n_i (\bar{Y}_i. - \bar{Y})^2 / (K - 1)$$

Where, k-1= degree of freedom,

Y= mean of data

n = the total number of scores.

4. Bonferroni

$$\alpha_B = \frac{\alpha_{FWE}}{c}$$

$\alpha_B$ = is the new alpha based on the Bonferroni test that should be used to evaluate each comparison or significance test

$\alpha_{FWE}$ = the family wise error rate as computed in the first formula

*C* = is the number of comparisons (statistical tests).

## DISCUSSION AND RESULT

***Table1:*** *Demographic Data of all the variables included using descriptive analysis.*

| Characteristics | Mean | Standard deviation | Standard error of mean |
|---|---|---|---|
| **Age** | 48.74 | 17.49 | 0.71 |
| **Height** | 164.8 | 9.16 | 0.37 |
| **Weight** | 66.15 | 12.99 | 0.53 |
| **BMI** | 24.41 | 4.23 | 0.17 |

This table shows the Mean, Standard deviation and Standard error of mean by the use of descriptive analysis i.e. Age with a mean of 48.74,standard deviation of ±17.49 and a standard error of mean of 0.71.Height with a mean of 164.8, standard deviation of ±9.16 and a standard error of mean of 0.37.Weight with a mean of 66.15, standard deviation of ±12.99 and a standard error of mean of 0.53.BMI with a mean of 24.41, , standard deviation of ±4.23 and a standard error of mean of 0.17 respectively.

***Table 2:*** *Normative Data for the grip strength and pinch strength for the right side and left side.*

| | N | Mean | Std. Deviation | Minimum | Maximum |
|---|---|---|---|---|---|
| **HGRT** | 600 | 27.2860 | 8.67532 | 10.00 | 52.00 |
| **HGLT** | 600 | 26.5906 | 9.17632 | 8.00 | 52.00 |
| **PGRT** | 600 | 9.3335 | 2.05775 | 4.00 | 33.11 |
| **PGLT** | 600 | 9.0188 | 2.15755 | 2.00 | 14.00 |

This table shows the Mean, Standard deviation, Minimum and Maximum values of hand grip of right hand and hand grip of left hand with a mean value of 27.2860 and 26.5906, standard deviation ±8.67532 and ±9.17632 with the minimum value of 10.00 and 8.00 and maximum value of 52.00 and 52.00, respectively. Mean, Standard deviation, Minimum and Maximum values of pinch grip of right hand and pinch grip of left hand with a mean value of 9.3335 and 9.0188, standard deviation ±2.05775 and ±2.15755 along with the minimum value of 4.00 and 2.00 and maximum value of 33.11 and 14.00 respectively.

***Table 3:*** *Significance Level in between the age groups in HGRT, HGLT, PGRT, and PGLT using one way Anova.*

| | | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|---|
| HGRT | Between Groups | 1010.983 | 3 | 336.994 | 4.557 | .004 |
| | Within Groups | 44070.449 | 596 | 73.944 | | |
| | | | | | | |
| HGLT | Between Groups | 1044.808 | 3 | 348.269 | 4.202 | .006 |
| | Within Groups | 49393.943 | 596 | 82.876 | | |
| | | | | | | |
| PGRT | Between Groups | 30.526 | 3 | 10.175 | 2.420 | .065 |
| | Within Groups | 2505.841 | 596 | 4.204 | | |
| | | | | | | |
| PGLT | Between Groups | 21.958 | 3 | 7.319 | 1.577 | .194 |
| | Within Groups | 2766.404 | 596 | 4.642 | | |
| | | | | | | |

This table shows F value and Significance in between groups and within groups of hand grip and pinch grip of left and right hands respectively with the help of anova. HGRT shows f value of 4.557 and significance of 0.004 in between groups. HGLT shows f value of 4.202 and significance of 0.006 in between groups .PGRT shows f value of 2.420 and significance of 0.065 in between groups. PGLT shows f value of 1.577 and significance of 0.194 in between groups.

***Table 4:*** *BONFERONI Post Hoc analysis for between group differences in the variables.*

| Dependent Variable | | | Significance | 95% Confidence Interval | |
|---|---|---|---|---|---|
| | | | | Lower bound | Upper bound |
| HGRT | 18-40 | 41-60 | 0.045 | .0341 | 4.0036 |
| | | 61 and above | 0.000 | 4.277 | 8.2663 |
| | 41-60 | 18-40 | 0.045 | -4.0036 | -.0341 |
| | | 61 and above | 0.000 | 2.2630 | 6.2426 |
| | 61 and above | 18- 40 | 0.000 | -8.2663 | -4.2770 |
| | | 41-60 | 0.000 | -6.2426 | - 2.2630 |
| HGLT | 18-40 | 41-60 | 0.002 | .8646 | 5.0777 |
| | | 61 and above | 0.000 | 4.4066 | 8.6408 |
| | 41-60 | 18-40 | 0.002 | -5.0777 | -.8646 |
| | | 61 and above | 0.000 | 1.4407 | 5.6645 |

| | | | | | |
|---|---|---|---|---|---|
| | 61 and above | 18-40 | 0.000 | -8.6408 | -4.4066 |
| | | 41-60 | 0.000 | -5.6645 | -1.4407 |
| PGRT | 18-40 | 41-60 | 0.041 | .0143 | .9277 |
| | | 61 and above | 0.000 | 1.3860 | 2.3040 |
| | 41-60 | 18-40 | 0.041 | -.9277 | -.0143 |
| | | 61 and above | 0.000 | .9162 | 1.8360 |
| | 61 and above | 18-40 | 0.000 | -2.3040 | -1.3860 |
| | | 41-60 | 0.000 | -1.8318 | -.9162 |
| PGLT | 18-40 | 41-60 | 0.004 | .1392 | .9577 |
| | | 61 and above | 0.000 | 2.6301 | 3.4526 |
| | 41-60 | 18-40 | 0.004 | -.9577 | -.1392 |
| | | 61 and above | 0.000 | 2.0826 | 2.9031 |
| | 61 and above | 18-40 | 0.000 | -3.4526 | -2.6301 |
| | | 41-60 | 0.000 | -2.9031 | -2.0826 |

Bonferroni Post Hoc Analysis was used to compare the difference in the variables in between all the groups. The significance i.e. P in HGRT is 0.045, 0.000, 0.045, 0.000, 0.000, 0.000. The significance i.e. P in HGLT is 0.002, 0.000, 0.002, 0.000, 0.000, 0.000. The significance i.e. P in PGRT is 0.041, 0.000, 0.041, 0.000, 0.0000, 0.000. The significance i.e. in PGLT is 0.004, 0.000, 0.004, 0.000, 0.000, 0.000.

***Table 5.*** *Shows correlation between weight, height, BMI and HGRT, HGLT, PGRT, PGLT.*

| | | HGRT | HGLT | PGRT | PGLT |
|---|---|---|---|---|---|
| Weight | Pearson correlation | 0.167** | 0.213** | 0.084* | 0.023 |
| | Sig.(2 tailed) | 0.000 | 0.000 | 0.040 | 0.571 |
| Height | Pearson correlation | 0.518** | 0.520** | 0.257** | 0.282** |
| | Sig.(2 tailed) | 0.000 | 0.000 | 0.000 | 0.000 |
| BMI | Pearson correlation | -0.157** | -0.118** | -0.104* | -0.189** |
| | Sig.(2 tailed) | 0.000 | 0.004 | 0.011 | 0.000 |

This table shows the correlation of WEIGHT, HEIGHT, BMI with HGRT, HGLT, PGRT and PGLT with Pearson's Correlation. Weight has a correlation of 0.167**, 0.213**,0.084*,0.023 with a significance of 0.000, 0.000, 0.040, 0.571 with HGRT,HGLT,PGRT and PGLT. Height has a correlation of 0.518**,0.520**,0.257**,0.282** with a significance of 0.000, 0.000, 0.000, 0.000 with HGRT,HGLT,PGRT and PGLT. BMI has a correlation negative correlation -0.157**,-0.118**,-0.104*, -0.189** with a significance of 0.000, 0.004, 0.011, 0.000 with HGRT, HGLT, PGRT and PGLT respectively.

***Table 6.*** *Shows the Mean, Standard deviation, Upper Bound and Lower Bound of HGRT.*

| **HGRT** | **N** | **MEAN** | **STANDARD DEVIATION** | **95% CI** | |
|---|---|---|---|---|---|
| | | | | **UPPER BOUND** | **LOWER BOUND** |
| **18 – 40 Years** | 200 | 30.0354 | 8.08083 | 31.1621 | 28.9086 |
| **41 – 60 Years** | 200 | 28.0165 | 8.94813 | 29.2574 | 26.7750 |
| **61 Years And Above** | 200 | 23.76737 | 7.77762 | 24.8537 | 22.6737 |

This table shows Mean, Standard deviation, Upper Bound and Lower Bound values of HGRT with the values of 30.0354, 8.08083, 31.1621, 28.9086, 28.0165, 8.94813, 29.2574,

26.7750,.23.76737, 7.77762, 24.8537, 22.6737 with 95% confidence interval in the age cohort of 18-40 years, 41-60years and 61 years and above respectively.

***Table 7.*** *shows the mean, standard deviation, upper bound and lower bound of HGLT.*

| HGLT | N | MEAN | STANDARD DEVIATION | 95% CI | |
|---|---|---|---|---|---|
| | | | | UPPER BOUND | LOWER BOUND |
| **18 – 40 Years** | 200 | 29.7437 | 9.07033 | 31.0084 | 28.4789 |
| **41 – 60 Years** | 200 | 26.7725 | 9.19783 | 28.0486 | 25.4964 |
| **61 Years And Above** | 200 | 23.2199 | 8.06624 | 24.3504 | 22.0895 |

This table shows Mean, Standard deviation, Upper Bound and Lower Bound values of HGLT with the values of 29.7437, 9.07033, 31.0084, 28.4789, 26.7725, 9.19783, 28.0486, 25.4964, 23.2199, 8.06624, 24.3504, 22.0895 with 95% confidence interval in the age cohort of 18-40 years, 41-60years and 61 years and above respectively.

***Table 8.*** *Shows the mean, standard deviation, upper bound and lower bound of PGRT*

| PGRT | N | MEAN | STANDARD DEVIATION | 95% CI | |
|---|---|---|---|---|---|
| | | | | UPPER BOUND | LOWER BOUND |
| **18 – 40 Years** | 200 | 10.1009 | 1.36596 | 10.2914 | 9.9104 |
| **41 – 60 Years** | 200 | 9.6299 | 1.73669 | 9.8708 | 9.3890 |
| **61 Years And Above** | 200 | 8.2559 | 2.46126 | 8.6009 | 7.9110 |

This table shows Mean, Standard deviation, Upper Bound and Lower Bound values of PGRT with the values of 10.1009, 1.36596, 10.2914, 9.9104, 9.6299, 1.73669, 9.8708, 9.3890, 8.2559, 2.46126, 8.6009, 7.9110 with 95% confidence interval in the age cohort of 18-40 years, 41-60years and 61 years and above respectively.

***Table 9.*** *Shows the mean, standard deviation, upper bound and lower bound of PGLT.*

| PGLT | N | MEAN | STANDARD DEVIATION | 95% CI | |
|---|---|---|---|---|---|
| | | | | UPPER BOUND | LOWER BOUND |
| **18 – 40 Years** | 200 | 10.2071 | 1.37979 | 10.3995 | 10.0147 |
| **41 – 60 Years** | 200 | 9.6586 | 1.64779 | 9.8872 | 9.4300 |
| **61 Years And Above** | 200 | 7.1658 | 2.03866 | 7.4515 | 6.8800 |

This table shows Mean, Standard deviation, Upper Bound and Lower Bound values of PGRT with the values of 10.2071, 1.37979, 10.3995, 10.0147, 9.6586, 1.64779, 9.8872, 9.4300, 7.1658, 2.03866, 7.4515, 6.8800 with 95% confidence interval in the age cohort of 18-40 years, 41-60years and 61 years and above respectively.

## CONCLUSION

In the study the normative value of hand grip and pinch grip was found. The grip strength of the hand was divided into a cohort of 18-40, 41-60, 60 and above both for the left hand and right hand. The mean grip strength for the right hand with the above mentioned cohort was 30.03, 28.01, 23.76. The mean grip strength for the left hand with the above mentioned cohort was 29.74, 26.77, 23.21. The mean pinch strength for the right hand with the above mentioned cohort was 10.10, 9.62, 8.25. The mean pinch strength for the right hand with the above mentioned cohort was 10.20, 9.65, 7.16. Hand grip and pinch also shows significant positive correlation with weight, height and significant negative correlation with BMI. Hence

the normative data in the healthy Indian population has been investigated.

| HGRT | N | MEAN | STANDARD DEVIATION | 95% CI | |
|---|---|---|---|---|---|
| | | | | UPPER BOUND | LOWER BOUND |
| **18 – 40 Years** | 200 | 30.0354 | 8.08083 | 31.1621 | 28.9086 |
| **41 – 60 Years** | 200 | 28.0165 | 8.94813 | 29.2574 | 26.7750 |
| **61 Years And Above** | 200 | 23.76737 | 7.77762 | 24.8537 | 22.6737 |

| HGLT | N | MEAN | STANDARD DEVIATION | 95% CI | |
|---|---|---|---|---|---|
| | | | | UPPER BOUND | LOWER BOUND |
| **18 – 40 Years** | 200 | 29.7437 | 9.07033 | 31.0084 | 28.4789 |
| **41 – 60 Years** | 200 | 26.7725 | 9.19783 | 28.0486 | 25.4964 |
| **61 Years And Above** | 200 | 23.2199 | 8.06624 | 24.3504 | 22.0895 |

In our study Bonferroni Post Hoc Analysis was used to compare the difference in the variables in between all the groups. This analysis was done because there significance found in anova. The significance i.e. P in HGRT is 0.045, 0.000, 0.045, 0.000, 0.000, 0.000. The significance i.e. P in HGLT is 0.002, 0.000, 0.002, 0.000, 0.000, 0.000. The significance i.e. P in PGRT is 0.041, 0.000, 0.041, 0.000, 0.0000, 0.000. The significance i.e. in PGLT is 0.004, 0.000, 0.004, 0.000, 0.000, 0.000.

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