Scholars Journal of Applied Medical Sciences (SJAMS) **ISSN 2320-6691 (Online)**
Sch. J. App. Med. Sci., 2017; 5(5B):1837-1840 **ISSN 2347-954X (Print)**

(An International Publisher for Academic and Scientific Resources)
www.saspublishers.com DOI: 10.36347/sjams.2017.v05i05.025

Original Research Article

Normative Values of Pinch Strength in Pune- India Population

Dr. Prajakta Namjoshi[1], Dr. Ravinder Kaur[2], Dr. Upasana Mishra[3], Dr. Parag Sancheti[4]
[1]MPT student, Sancheti Institute College of Physiotherapy, Shivaji nagar, Pune, India
[2]Professor, MAEER'S Physiotherapy College, Talegaon, India
[3]Physiotherapist, Noble Hospital, Pune, India
[4]Chairman, Sancheti Institute for Orthopaedics and Rehabilitation, Pune, India

***Corresponding author**
Dr. Prajakta Namjoshi
Email: doc.ashokshyam@gmail.com

Abstract: Normative data published for pinch strength is available for many countries but as there are genetic, nutritional, environmental etc. variations in different regions it is necessary to find out normative data for pinch strength in different regions or countries. The main purpose of this study was to establish normative data for pinch strength (palmar pinch, lateral or key pinch and tip to tip pinch) in 6-80 years old population of Pune city area. A Saehen hydraulic pinch gauge was used to measure palmar pinch strength, key pinch strength and tip to tip pinch strength. The sample size was 510 and pinch strength was tested using a standardized position given by American Society of Hand Therapists. The subjects were selected by stratified sampling and were divided into 8 groups according to their age. Statistical analysis of the collected data was done. The mean tip to tip strength was greater in 21-30 years. The mean palmar pinch strength was greater in 21-30 years. The mean lateral or key pinch strength was greater in 21-30 years. The pinch strength was seen to decline after 60 years of age.
Keywords: Palmar pinch strength, key pinch strength, tip to tip pinch strength, normative data

INTRODUCTION

The hand is a complex and well differentiated musculoskeletal structure which has the largest representation in the nervous system in relation to its size [1]. In order to cope with the demands of daily life, full function and adequate strength of the hand is necessary [1]. Many activities of daily living involve the use of hand with various pinch grasps or hand grips for doing tasks. Pinch grip involves the use of any one finger or combination of fingers along with the thumb without contact with the palm to manipulate objects [2]. There are three types of pinch grasps;-tip to tip, pad to side prehension (key grip or lateral pinch) and pad to pad or palmar prehension [3]. The activities of daily living tasks involving key pinch are inserting or removing a key or ATM card, eating with a spoon etc. [4]. Palmar pinch is required for holding a pen while writing etc while tip to tip pinch is required for holding fine objects like grains of rice etc.

One of the important functions of the hand is the ability to grip and manipulate an object and this ability can be affected which can hamper the performance of activities of daily living [2]. Hand strength assessment is considered as a reliable and objective parameter for measuring the functional integrity of the hand [5]. Strength testing for hand is easy and inexpensive and is performed frequently for evaluating the outcomes following upper extremity injuries [6]. It can be used clinically for assessing the effectiveness of different treatment techniques in traumatic hand diseases as well as in degenerative diseases affecting the hand [5]. Thus, pinch strength can be considered to be an objective outcome parameter to measure and quantify the outcome before and after orthopedic and physiotherapy interventions [1].

Normative data for pinch strength is necessary when evaluating the impact of damage to either the musculoskeletal or nervous system of hand [7]. The physiotherapy application of the data will be to keep a check on the process of recovery in patients with upper extremity damage [7]. Comparison between the affected hand and the non-affected hand can be done to assess pinch strength, however when the contra lateral side is also compromised by the underlying disease or

its treatment then other markers are required [1]. Hence normative data for pinch strength of healthy population is necessary [1]. In addition to this, normative data also helps in the interpretation of the evaluation and helps in setting realistic treatment goals [1]. Thus in order to determine whether the individual has impaired pinch strength, comparison can be made between his or her performance and the reference values obtained from the relevant population.

Mathiowetz *et al.;* determined the normative values for pinch strength for healthy adults and it was found out that the average scores of key pinch, palmar pinch and tip to tip pinch were relatively stable from 29 to 59 years and it gradually declined from 60 to 79 years [8]. Werle S *et al.;* while determining normative values of grip and pinch strength in healthy adult Swiss population came to a conclusion that hand strength values differed significantly from those of the other populations [5]. In a study by Anjum SN *et al.;* it was concluded that the normal values for grip and pinch strength are lower for Asian as compared with European groups and hence the published data for Europeans should not be used as the reference standard for Asian populations [9]. Normative data for pinch strength for healthy population is available for many countries but as there are genetic, nutritional and environmental variations in different regions it is necessary to find out normative data for pinch strength according to different regions or countries [5, 10]. Hence, the aim of this study was to determine the normative values of pinch strength for 6 to 80 year old population group in Pune region of Indian subcontinent. The objectives of the study were to find out normative values for tip to tip pinch, palmar pinch and key or lateral pinch.

METHOD

This observational cross sectional study was undertaken in the community in Pune city, Maharashtra. The ethical approval was granted by the Institute's ethical board before implementation of the study. The inclusion criterion for the study was normal healthy individuals in the age group of 6-80 years in Pune city. Individuals with history of any upper limb injury less than six months or neurological involvement causing muscle weakness or sensory loss were excluded from the study.

Methodology: Study and study design was approved by the Institute's ethical committee. 510 normal healthy individuals participated in the study depending on the inclusion criteria and their willingness to participate in the study. Before commencing the research study, informed written consent was taken from individuals participating in the study. The subjects were selected by stratified sampling and divided into eight groups according to their age. Demographic data of each participant was recorded. The hand position was according to that given by American Journal of Occupational Therapy [11]. For each test of pinch strength, the subjects were seated with their shoulder adducted and neutrally rotated, elbow flexed at 90°, forearm in neutral position and wrist between 0-15° extension and between 0-15°ulnar deviation [11]. A Saehen hydraulic pinch gauge was used to measure palmar pinch strength, key pinch strength and tip to tip pinch strength in kilograms. For each strength test, standard instructions were followed, and the scores of three successive trials were recorded for each hand.

RESULTS

STATISTICAL ANALYSIS

This study was undertaken to find out the normative values of pinch strength i.e. palmar pinch, key or lateral pinch and tip to tip pinch in normal healthy population in Pune city. A total of 510 individuals in the age group of 6-80 years participated in the study. The data collected was assessed. Data was analyzed using Microsoft Excel 2010. Descriptive statistics i.e. mean and standard deviation was determined for all types of pinch strength in all eight groups.

Table 1 shows the normative values for pinch strength (tip to tip, palmar and lateral or key pinch) in healthy individuals in Pune city region.

		Male			Female		
AGE	SIDE	TIP TO TIP	PALMAR	KEY	TIP TO TIP	PALMAR	KEY
6-10	R	1.53±0.64	2.46±0.8	3.37±0.91	1.00±0.31	2.04±0.15	2.52±0.37
	L	1.47±0.47	2.30±0.76	3.17±0.73	0.91±0.20	1.72±0.41	2.20±0.45
11-20	R	2.11±0.71	3.53±0.66	4.58±0.82	1.75±0.70	3.44±1.26	4.48±1.15
	L	2.01±0.52	3.08±0.6	4.18±0.83	1.89±0.76	3.04±0.93	4.05±1.06
21-30	R	3.94±1.34	6.02±2.17	7.61±1.60	2.31±0.93	3.64±0.91	5.0±1.02
	L	3.47±1.33	5.58±1.79	7.41±1.76	2.13±0.94	3.17±1.05	4.55±1.16
31-40	R	3.14±1.37	4.43±1.67	6.5±1.55	1.90±0.6	3.48±0.97	4.67±0.98
	L	3.08±1.12	4.47±1.49	6.12±1.55	1.97±0.57	3.36±1.03	4.39±0.96
41-50	R	3.14±0.60	4.53±0.77	6.48±1.65	2.32±0.71	3.71±1.03	4.81±1.31
	L	3.22±1.22	4.84±1.18	6.67±1.32	2.18±0.68	3.55±0.82	4.79±1.43
51-60	R	3.01±1.17	3.98±1.33	6.06±1.31	1.33±0.48	2.37±0.81	4.05±1.05
	L	2.27±0.94	3.32±1.33	5.45±1.01	1.46±0.50	2.43±0.87	3.83±1.17
61-70	R	3.01±0.71	4.43±0.88	6.3±1.48	1.15±0.55	2.42±0.58	3.48±0.80
	L	2.96±0.86	4.48±1.19	5.9±1.34	1.09±0.52	2.32±0.73	3.3±0.78
71-80	R	2.08±0.77	3.75±1.25	5.16±1.28	1.02±0.28	1.89±0.65	3.10±0.79
	L	1.87±0.72	3.54±0.89	4.72±1.13	1.28±0.61	2.15±0.61	3.10±0.81

DISCUSSION

Pinch strength measurement using a pinch gauge is simple, easy to perform and reliable. It helps to determine results which are simple to record [2]. This study was undertaken to find out the normative values of pinch strength in normal, healthy population in Pune city. The results of our study suggest that males have greater pinch strength as compared to that of females. Also, the mean pinch strength i.e. tip to tip pinch, palmar pinch and lateral or key pinch was found to be higher in individuals with the age group of 21-50 years. As age increases the pinch strength increases up to the age 21years and then it remains more or less constant till 50 years of age and after which it starts to decline as the age further increases.

Our study has findings similar to a study performed by Mathiowetz V *et al.;* in healthy individuals which concluded that higher grip strength scores were found in the age group of 25-39 years [8]. It was also found that the average pinch strength score were relatively stable from 29-59 years after which there was a decline [8]. Carmelli E *et al.;* has suggested that hands undergo many physiological and anatomical changes during ageing process [12]. Thus, it can lead to reduction of hand grip strength as age advances. Also, Shim JH *et al.;* came to a conclusion that hand strength was increased during young adulthood i.e. 20 to 29 years and declined in the geriatric population [6]. The increase in hand strength can be attributed to the increase in the muscular mass which peaks in the early adulthood period during the normal human development [6]. Mohammadian M *et al.;* assessed the pinch strength of males and females and came to the conclusion that there are significant differences in the pinch strength of males and females which can be due to differences in gender specific muscle fibers [7].

The limitation of this study is that, it is not known that sample for pinch strength in Pune population can be a representation for the whole country. Future research is needed to check if a correlation exists between the pinch strength and anthropometric factors forearm position or the occupation of the individual.

CONCLUSION

This study provides normative values for pinch strength in healthy Pune population which can be used as reference values and can be used clinically to assess pinch strength pre and post treatment or surgery.

Conflict of Interest: There are no conflicts of interest.

Financial support and sponsorship: Nil

Acknowledgment: The authors would like to thank all the participants who participated in the study.

REFERENCES

1. Angst F, Drerup S, Werle S, Herren DB, Simmen BR, Goldhahn J. Prediction of grip and key pinch strength in 978 healthy subjects. BMC musculoskeletal disorders. 2010 May 19; 11(1):94.
2. Puh U. Age-related and sex-related differences in hand and pinch grip strength in adults. International

Journal of Rehabilitation Research. 2010 Mar 1; 33(1):4-11.
3. Noelle M et al. The Wrist and Hand Complex. In Joint Structure and Function. Fifth Ed. Jaypee Brothers Medical publishers, New Delhi (F A Davis Company, Philadelphia) 2012: 346.
4. Michael AI, Iyun AO, Olawoye OA, Ademola SA, Nnabuko RE, Oluwatosin OM. Normal values of key pinch strength in a healthy Nigerian population. Annals of Ibadan postgraduate medicine. 2015; 13(2):84-8.
5. Werle S, Goldhahn J, Drerup S, Simmen BR, Sprott H, Herren DB. Age-and gender-specific normative data of grip and pinch strength in a healthy adult Swiss population. Journal of Hand Surgery (European Volume). 2009 Jan 7.
6. Shim JH, Roh SY, Kim JS, Lee DC, Ki SH, Yang JW, Jeon MK, Lee SM. Normative measurements of grip and pinch strengths of 21st century Korean population. Archives of plastic surgery. 2013 Jan 1; 40(1):52-6.
7. Mohammadian M, Choobineh A, Haghdoost A, Hasheminejad N. Normative data of grip and pinch strengths in healthy adults of Iranian population. Iranian journal of public health. 2014 Aug; 43(8):1113.
8. 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 Feb 2; 66(2):69-74.
9. Anjum SN, Choudary P, Dimri R, Ankarath S. Comparative evaluation of grip and pinch strength in an Asian and European population. Hand Therapy. 2012 Mar; 17(1):11-4.
10. Walankar P, Verma C, Mehta A. Study of Hand Grip Strength in Indian Population. International Journal of Health Sciences and Research (IJHSR). 2016; 6(11):162-6.
11. Fess, E.E. Grip strength. Clinical Assessment Recommendations in J.S. Casanova (Ed.), 1992; pp. 41–5). 2nd edition. American Society of Hand Therapists, Chicago
12. Carmeli E, Patish H, Coleman R. The aging hand. J Gerontol, 2003; 58A: 146–152.