A Cross Sectional Study on Middle Finger Tip Pinch, Ring Finger Tip Pinch, Little Finger Tip Pinch Strengths : The Correlations with Anthropometric Variables in North Indian Population

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Abstract

Introduction: Pinch strength in addition to handgrip strength is considered an important factor in the assessment of proper hand muscle function. Various parameters like nutritional status, physical activities and muscle pathologies can affect the overall gripping capabilities of the fingers .The unique abilities of opposition in human hand is because of the distinct articular surfaces in the miniature bones and intrinsic muscles of the hand. Due to fine neuromuscular coordination and sensory perception in the digits, firm grasping abilities and in the hand pinches have developed. These grasps can be very useful for sensory and motor capabilities of the hand specially in sports like cricket, baseball and volleyball.

AIM: To generate data for middle finger tip pinch, ring finger tip pinch, little finger tip pinch strengths and to evaluate their correlations with other anthropometric indices.

Materials and Methods: Four hundred and fifty healthy young adult individuals were selected for the study. A pinch gauze was used to measure pinch grip strengths in both the sides. Pearson's correlation test and independent t-tests were used. SPSS Version 20 was used for statistical analysis.

Result: Mean age of the population was 22 years and all the subjects were males. Pinch grip strength in all the pinches were found to be greater in dominant side than non dominant side ($p<0.001$). There was significant association between middle finger tip pinch and anthropometric indices. No statistically significant correlation of little finger tip pinch with waist circumference, waist to hip ratio and BMI was observed.

Conclusion: The analysis provides normative data for pinch grip strengths and their correlation with other anthropometric indices in adult North Indian population.

***Keywords** : Pinch grip strength , BMI, Indian population*

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Introduction

Sports activities need high level of forearm and hand muscle strength[1].Tip pinch is stated to be a positioning pinch useful in daily life activities needed for fine motor skills instead of hand grip and pinch strengths[2].Dental surgeons are at an increased risk of musculoskeletal

disorders due to repetitive hand function, pinch force and sustained hand postures. Various factors can affect pinch strength like hand dominance, height, body weight, age, finger strength etc[3]. Salam FA conducted a study to evaluate the grip and pinch strengths of these professionals[4].

In the field of dentistry, the management of patient by dental surgeons is done in an inflexible work posture because of which musculoskeletal disorders tend to develop quiet early in their carrier. During periodontal scaling, high pinch force is applied; development of muscular fatigue is quiet common and this affects the pinch strengths. Pinch grip hence becomes an important index in hand therapy evaluations. Pinch force is also affected by general weakness, nutritional status, physical activities, muscle disabilities, decrease of cognitive measures .

Studies concerning pinch strength of middle finger tip pinch, ring finger tip pinch and little finger tip pinch are lacking. It is stated that the muscle of obese individual have fatty infiltration and alteration in the distribution of type 1 and type II muscle fibres which also enhances muscle strength and endurance[5]. Waist to height ratio is an useful parameter for discriminating hypertension, diabetes and dyslipidemia in both the genders. It is found to be more precise measure of body fat distribution[6]. Waist- hip ratio (WHR) above 0.9 for males and 0.85 for females or a BMI above 30 is a possible indicator of obesity and other more serious health conditions according to World Health Organization (WHO)[7].

In fast pitch of baseball the index and middle finger tips are used in the perpendicular seam of baseball, the thumb lies underneath the baseball resting on the smooth leather[8].That is why the role of pinch strength in such sports is important.

Daily life activities like insertion and removal of a key or the Automated Teller Machine (ATM) Card, operating clothes with zipper, insertion or removal of a plug, eatables requiring the insertion of prongs of a fork, operating a remote control or holding a pen all need good pinch strength[9].

Considering the relevance of these parameters in sports and day to day life activities the study was conducted to establish the correlation of anthropometric indices.

Present study will be helpful to establish the relationship between BMI and other anthropometric indices on pinch grip strengths and role of physical activities and fitness on overall health of medical students for their better performance in academics and sports.

Material and Method

Participants:

This cross sectional study was conducted on four hundred fifty young healthy adult North Indian males, in the age group of 18-26 years. The participants were medical students of MMIMSR, MMDU , Mullana, Ambala, Haryana. The study was conducted from Mar 2017 to Feb 2019 .

The subjects with any neuromuscular and musculoskeletal impairment of upper limb or any cardio-systemic illness after taking adequate history were excluded from the study. Prior informed consent were taken from the participants. The study was approved (Project No. IEC-1132) by Institute Research And Ethics Committee.

Measurements:

A pinch gauze (Saehan Corp. Masan, Korea, ModelNo.SH5005) was used to assess middle finger tip pinch, ring finger tip pinch & little finger tip pinch on both dominant and non dominant sides. Subjects were asked to sit with shoulders adducted, elbow flexed to 90 °forearm in neutral position, wrist between 0 °to 30 ° of extension and 0 °to 15 °ulnar deviation. Pinch measurements were performed with wrist, forearm, elbow, shoulders in neutral position. Height was measured in metres using stadiometer. Heels, buttocks, shoulders were in contiquity with flat rigid surface or wall during the assessment and head was in easeful, upright position.

Weight of subjects were measured in kilograms with help of electronic weighing scale (unicare). Subject was asked to stand freely, barefooted on the weighing scale with equally distributed weight with empty pockets.

Subjects were directed to nip the pinch gauze by pressing the tip of the pollex with the tip of the middle

finger , ring finger, little fingertip pinch respectively for measuring the three tip pinches as shown in Fig. 1

Fig.1

Waist circumference was measured in centimetres by using the elastic measuring tape under the recommended guidelines of WHO. The subject stood erect, abdomen relaxed , arms by the sides and with normal respiration. Assessment was done after the end of normal expiration and practice repeated test trails .

Hip circumference was measured in centimetres by using a measuring tape. Measurement was done keeping the measuring tape parallel to the floor. Waist to hip ratio was measured by using the formula WHR=WC(cm)/ HC(cm).Waist to height ratio was measured by using the formula WHTR= WC (CM)/HEIGHT(cm).BMI was measured by using the formula BMI=weight(kg)/ height(m^2).

Statistical Analysis

Difference between dominant and non dominant handgrip strength were compared using Independent T Test, Pearson's test .The relationship between pinch strength of dominant and non dominant side and anthropometric indices for analyzing , statistical analysis were done using SPSS version 20. P value <0.05 was considered statistically significant.

Results

A total of 67% of participants were right handed and

26% were left handed. Pinch strength of three pinches in dominant side were greater than non dominant side under the study as observed from table no. 1.

Positive correlation of Thumb middle finger tip pinch was found with all the variables. Significant association was observed with all the anthropometric indices except age, waist to hip ratio as seen in table no 2.

Negative correlation of ring finger tip pinch was found with age and significant association was observed with all the anthropometric indices except age, waist to hip ratio, waist to height ratio & BMI as observed from table no.3.

Negative correlation of little finger tip pinch was observed with age and waist to hip ratio. Significant association was found with all the anthropometric indices except age, waist to hip ratio, waist to height ratio and BMI as observed from table no.4.

Table no 1: Baseline data of pinch grip strengths in the study population

Variables	**Handedness**	**Mean ± SD**
Thumb middle finger tip pinch	Right hand Left hand	11.68±3.14 11.18±3.13
Thumb ring finger tip pinch	Right hand Left hand	8.88±3.17 8.49±2.67
Thumb little finger tip pinch	Right hand Left hand	5.38±2.21 5.13±2.12

Table No.2

Variable	**Side**	**r-value**	**p-value**
	R	.037	.431
	L	.046	.331
	R	.265	<0.001**
	L	.279	<0.001**
Age (year)	R	.124	< 0.009*
Weight (kg)	L	.175	<0.001**
Height (m)	R	.269	<0.001**
WC (cm)	L	.175	<0.001**
HC (cm)	R	.229	0.001**
WHR	L	.188	<0.001**
WHtR	R	-.004	.926
BMI (kg/m²)	L	.084	0.73
	R	.194	<0.001**
	L	.137	0.004*
	R	.229	<0.001**
	L	.226	<0.001**

Correlations of middle tip pinch strength with anthropometric indices

*p<0.05; significant;**<0.001;highly significant

Table no.3: Correlations of ring finger tip pinch strength with anthropometric indices

Variables	Handedness	r value	p value
	R	-.006	.897
	L	.032	.498
	R	.154	<0.001**
	L	.164	0.007*
Age (year)	R	.095	.045
Weight (kg)	L	.142	0.002*
Height (m)	R	.164	<0.001**
HC (cm)	L	.095	.045
WC (cm)	R	.141	0.003*
WHR	L	.097	.040
WHtR	R	.001	.990
BMI (kg/m²)	L	.037	.428
	R	.113	.017
	L	.056	.238
	R	.121	.010
	L	.119	.012

*p<0.05;significant;**<0.001;highly significant

Table no.4: Correlations of Little finger tip pinch strength with anthropometric indices

Variable	Side	r-value	p-value
	R	-.44	.353
	L	-.014	.767
	R	.128	0.007*
	L	.126	0.007*
Age (year)	R	.166	<0.001**
Weight (kg)	L	.175	<0.001**
Height (m)	R	.173	<0.001**
HC (cm)	L	.182	<0.001**
WC (cm)	R	.110	.019
WHR	L	.103	.028
WHtR	R	-.077	.104
BMI (kg/m²)	L	-.108	.023
	R	.058	.218
	L	.051	.283
	R	.063	.181
	L	.061	.200

*p<0.05; significant;**<0.001;highly significant

Discussion

There was a significant association in case of thumb middle tip pinch and ring finger tip pinch with BMI, but not significant in case of little finger tip pinch. Middle finger tip pinch as well as little finger tip pinch showed negative correlation with waist to hip ratio. Ring finger tip pinch had very less positive correlation with waist to hip ratio (r value Right side = .001and Left side = .037) in the current study.

It was found that the pinch strengths were high in male participants[10,11,12]. Longer fingers and larger hand span have stronger pinch strengths and a significantly reduced risk of mortality rate[11]. Present study findings are in coherence with these findings. Low to moderate correlation is reported between pinch strength and age[13]. This was also observed in the present study. It was observed that average pinch strength peaked between 35 and 44 yrs in men[14]. One study done on different medical professional groups established that dentists have maximum pinch strength among all the groups considered[15]. It was also found that pinch strength declines with rising age and was higher in dominant hand[16,17]. The trend of pinch strength variation according to age was not analyzed in the present study but it was found to be higher in dominant right handed individuals. Positive association of pinch strength with BMI is proved by another study where subjects with normal BMI had significantly higher grip strength than overweight and obese group[18].

Previously no study was conducted to find out the correlation between middle tip pinch, ring finger tip pinch, little finger tip pinch strengths with other anthropometric variables.

Limitations: The population under study is limited to medical students only, so results cannot be generalized over larger populations belonging to different professions or geographical locations for external validation. Although it was planned to include participants up to 26 years of age but very few above 23 years participated in the study.

Conclusions

This study showed that there is a positive correlation of pinch strengths with anthropometric indices such as weight and height. Future studies should be performed to evaluate the risk factors for reduced pinch strengths which can directly or indirectly affects the health of the individual. These factors should be considered while giving training to sports personnel for their better performance.

Conflict of Interest: Nil

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