



UNIVERSITI PUTRA MALAYSIA

***DETERMINATION OF HAND GRIP AND PINCH STRENGTH AMONG
YOUNG ADULT MALAYSIAN STUDENTS IN A PUBLIC UNIVERSITY IN
MALAYSIA***

NANCY MOHAMMED AHMED SAAD

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By

NANCY MOHAMMED AHMED SAAD

**Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia,
in Fulfillment of the Requirements for the Degree of Master of Science**

December 2018

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DEDICATION

This thesis is dedicated to my parents, supervisor and friends for their financial, moral and spiritual support.



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Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfilment of the requirement for the degree of Master of Science

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December 2018

Chairman : Professor Manohar A/L Arumugam, PhD
Faculty : Medicine and Health Sciences

Grip strength indicates the description of the status and general muscle strength of hand and overall upper extremity strength. It is an important measure used to evaluate outcomes of treatment after injured hands. Currently, there are not any established local data regarding grip strength norms. As such, these norms should be developed for various nationalities living in the same or different geographical region. The aim of the present study is to determine the hand grip and pinch strengths and its associated factors among Malaysian students in Universiti Putra Malaysia.

A cross-sectional study using multistage random sampling was carried out among Malaysian students aged 18-29 years in Universiti Putra Malaysia from November 2017 until April 2018. The sample size was 848 respondents based on two group mean comparison formula. Data was collected using Structured questionnaire on sociodemographic characteristics, medical history, lifestyle practices, and measurements, including anthropometry and handgrip strength were taken. Data collected coded and analyzed using IBM SPSS software. Data was analyzed using descriptive and analytical statistics. Pearson correlation test was used to examine the relationship between hand grip strength and pinch grip strength.

The results show that the overall response rate was 94% . Majority of the respondents were Malays (81.6%) followed by Chinese (12.4%) and finally Indian (6%). The overall mean age was 21.05 \pm sd= 1.79 years and ranged between 18 and 29 years. The overall mean hand grip strength (HGS) was 18.32 (\pm sd=5.99) kg and ranged between 8.17 to 41.0. The mean hand grip strength (HGS) for male students was 24.74 (\pm sd=7.66) kg and ranged between 11.50 to 41.00. While the overall mean HGS

among female students was 16.94 (\pm sd=7.66) kg and ranged between within 8.17 to 30.67. In Conclusion there was a significant relationship between hand grip strength and socio-demographic characteristics (age, gender, ethnicity, BMI and hand dominance). There was a significant association between BMI and pinch grip strength in terms of (KP, PP, TP) in both right and left hands. Gender, BMI, ethnicity and age are predictor factors that affecting hand grip strength. Three predictor factors which are gender, BMI and ethnicity were affecting key pinch and palmar pinch strengths. While only two predictors factors which are gender and BMI were affecting tip pinch.



Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk ijazah Master Sains

**PENENTUAN KEKUATAN GENGKAMAN DAN CUBITAN DI KALANGAN
PELAJAR MUDA, WARGA MALAYSIA DI SEBUAH UNIVERSITI AWAM
DI MALAYSIA**

Oleh

NANCY MOHAMED AHMED SAAD

Disember 2018

Pengerusi : Profesor Manohar A/L Arumugam, PhD
Fakulti : Perubatan dan Sains Kesihatan

Kekuatan cengkaman menunjukkan ciri-ciri status dan kekuatan otot secara umum dan kekuatan anggota badan atas secara keseluruhan. Ia merupakan ukuran penting digunakan dalam menilai hasil rawatan. Pada masa ini, tiada data tempatan yang boleh diterima pakai berkaitan norma kekuatan cengkaman. Justeru, norma ini perlu dibentuk bagi pelbagai bangsa yang tinggal di kawasan geografi yang sama atau berbeza. Objektif bagi kajian ini adalah untuk mengenalpasti kekuatan tangan dan cengkaman cubit dan faktor-faktor berkaitan dalam kalangan pelajar di Universiti Putra Malaysia.

Kajian keratan rentas menggunakan persampelan rawak berperingkat telah dijalankan dalam kalangan pelajar Malaysia berumur 18-29 tahun di Universiti Putra Malaysia daripada November 2017 sehingga April 2018. Saiz sampel adalah 848 responden berdasarkan formula perbandingan min dua kelompok. Data dikumpul menggunakan soal selidik berstruktur berkaitan ciri-ciri sosiodemografi, sejarah kesihatan, amalan gaya hidup, dan ukuran, termasuk antropometri dan kekuatan cengkaman tangan juga diambil. Data yang dikumpul dikod dan dianalisis menggunakan perisian IBM SPSS. Data dianalisis menggunakan statistik deskriptif dan analitik. Ujian korelasi Pearson digunakan untuk mengkaji hubungan antara kekuatan cengkaman tangan dan kekuatan cengkaman cubit.

Hasil kajian menunjukkan bahawa kadar respon secara keseluruhan adalah 94%. Majoriti responden adalah Melayu (81.6%) diikuti dengan Cina (12.4%) dan akhirnya India (6%). Purata keseluruhan umur adalah $21.05 \pm sp= 1.79$ tahun dan berada dalam lingkungan 18 dan 29 tahun. Purata keseluruhan kekuatan cengkaman tangan (HGS)

adalah 18.32 (\pm sp=5.99) kg dan berada dalam lingkungan 8.17 kepada 41.0. Purata keseluruhan kekuatan cengkaman tangan (HGS) bagi pelajar lelaki adalah 24.74 (\pm sp=7.66) kg dan berada dalam lingkungan 11.50 kepada 41.00. Manakala purata keseluruhan HGS bagi pelajar perempuan adalah 16.94 (\pm sp=7.66) kg dan berada dalam lingkungan 8.17 kepada 30.67. Kesimpulannya, terdapat hubungan signifikan antara cengkaman tangan dan ciri-ciri sosio demografi (umur, jantina, etnik, BMI dan tangan dominan). Terdapat hubungan signifikan antara BMI dan kekuatan cengkaman cubit dari segi (KP, PP, TP) bagi kedua-dua tangan kanan dan kiri. Jantina, BMI, etnik dan umur merupakan faktor peramal yang mempengaruhi kekuatan cengkaman tangan. Tiga faktor peramal iaitu jantina, BMI dan etnik mempengaruhi kekuatan cubitan kunci dan cubitan palmar. Manakala hanya dua faktor peramal iaitu jantina dan BMI yang mempengaruhi cubitan hujung.



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This thesis was submitted to the Senate of the Universiti Putra Malaysia and has been accepted as fulfilment of the requirement for the degree of Master of Science. The members of the Supervisory Committee were as follows:

Manohar a/l Arumugam MBBS, MS

Professor
Faculty of Medicine and Health Sciences
Universiti Putra Malaysia
(Chairman)

Lekhraj Rampal a/l Gyanchand Rampal

MBBS, MPH, DrPH, FRSH, FAMM, FAMS, FPHMM

Professor
Faculty of Medicine and Health Sciences
Universiti Putra Malaysia
(Member)

ROBIAH BINTI YUNUS, PhD

Professor and Dean
School of Graduate Studies
Universiti Putra Malaysia

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Signature: _____
Name of Chairman
of Supervisory
Committee: Professor Dr. Manohar a/l Arumugam

Signature: _____
Name of Member
of Supervisory
Committee: Professor Dr. Lekhraj Rampal a/l Gyanchand Rampal

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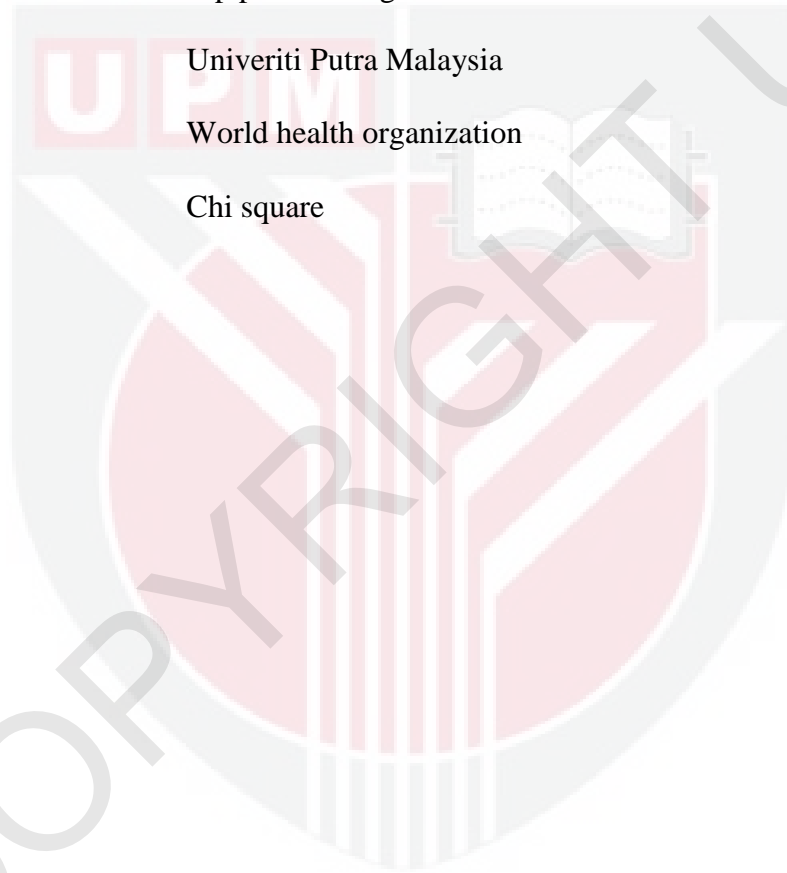
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LIST OF ABBREVIATIONS

%	Percentage
<	Less than
>	Greater than
≥	Greater than or equal to
ADLs	Activity of daily livings
ASHT	American Association of hand therapy
<i>B</i>	Standardized regression coefficients
BMI	Body mass index
CI	Confidence Interval
CSA	cross-sectional area
F	F statistic or F value
GS.R	Grip strength right
GS.L	Grip strength left
HGS	Hand grip strength
ICC	Intraclass correlation
IP	Interphalangeal
Kg	kilogram
KPS	Key pinch strength
Lb	Pound
M	mean
N	Sample size
<i>p</i>	α level of significance
PPS	Palmar pinch strength

PS	Pinch strength
r	Correlation coefficient
R ²	coefficient of determination
SD	Standard deviation
SE	Standard error
SI units	International system of units
TPS	Tip pinch strength
UPM	Univeriti Putra Malaysia
WHO	World health organization
X ²	Chi square



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CHAPTER 1

INTRODUCTION

1.1 Background

The hand responsible for tasks which require significant force, performs fine and sensual activities (Puh, 2010). One of the most important functions of the hand are grip and pinch; grip includes holding and grasping objects between fingers and hand palm (Mulmlerpatan, Karnik & John, 2013), while pinch includes the use of one or more fingers to hold objects in coordination with movement of the thumb without contacting the palm. Any injury in this function can deteriorate the daily living activities (Puh, 2010). Numerous line of works/ vocations depend on grip strength to perform major tasks for instance the admission requirement process for police departments, fire departments and the military services may require candidates to pass grip strength test (Nicolay & Walker, 2005). Food packers, production line workers and plentiful number of manual workers may use repetitive or forceful gripping activities (Dubrowski & Carnahan, 2004). Other jobs require carrying, rising and lifting weighty loads with a static grip. If the worker have a poor grip strength, his/her hands and forearm will liable to work related -musculoskeletal disorders (WRMDs) from the accumulated injury, like muscle strain, tendonitis, nerve impingement, carpal tunnel syndrome and many others (Boyles, Yearout & Rys, 2003; Nicolay & Walker, 2005). Assessment of Grip strength may assist identify humans at risk for WRMDs of the forearms and hands, determining the improvements of rehabilitation and treatment strategies (Nicolay & Walker, 2005; Peolsson, Hedlund & Birgitta, 2001). Some of the factors that closely relate to upper extremity function are daily living and social participation (Kim, 2016). In this regard, a well performing indicator of maximum voluntary hand force is the Handgrip Strength (HGS) (Moy, Darus & Hairri, 2015). It is also regarded as the most basic approach to evaluate muscle function, especially when the appropriate, calibrated equipment and methodology is used to obtain the measurements. The assessment is retrieved from the static force applied by the hand muscles grasped about the dynamometer (Schaap et al., 2016). Particularly among older people, hand strength may hint at the state of physical fitness and frailty (Lam et al., 2015), enabling practitioners to identify potential health risks sooner and intervene accordingly (Bohannon, 2001). Thus, some researchers have regarded hand grip strength is a reliable measure of age (Koopman et al., 2015).

The term of hand grip may also reliably forecast negative health effects which may even result in death or discharge from hospitals (Rantanen et al., 1999). Pidala et al. (2013) suggested that the rise of standard deviations regarding hand grip strength correlated with a massive decrease in mortality rates owing to cardiovascular diseases and cancer among males. Thus, it has also been used to screen and evaluate state of nutrition within hospitals and among the general public, especially those with lacking nutrition and suspected bad health (Norman et al., 2011). Researchers have demonstrated that changes in muscular function resulting from malnutrition precede

changes in other anthropometric parameters (Chilima & Ismail, 2001; Norman et al., 2011). Hand grip strength is a relatively simple and prognostic tool which may sort out health status, even potential disability, among middle-age adults and the elderly (Bohannon et al., 2008; Giampaoli et al., 1999). The measure of hand grip and pinch strengths and comparison with standard anthropometric data is widely considered a reliable approach in detecting hand damage and intensity (Mohammadian et al., 2014).

In daily tasks, grip and pinch functions are employed excessively. In the field of biomechanics, grip and pinch strengths are regarded as a form of static strength, which is the maximum voluntary muscle labor (contracting) applied during a restrained and stationary position (Taha & Sulaiman, 2011). The term static strength is equivalent to equidistant strength, which refers to the stabilizing force exerted on limbs in a resting position.

Normative data is crucial in the field of ergonomics in order to optimally design work schedules and tools. Furthermore, this data aids therapists in setting benchmarks for treatments, evaluating responses to treatment strategies as well as assessing one's health fitness to work. It has been apparent in the literature in the need to establish such normative data for hand grip strength (Wu et al., 2009).

The literature search conducted in the present study makes it apparent that handgrip strength strongly correlates to one's physical disability and mortality. Thus, the importance is placed on appropriately measuring handgrip strength, pinch strength, key pinch, palmar pinch and tip to tip pinch. These variables were measured among the adult population comprising Malaysian students, which is expected to greatly improve the wellness of health for the target population and contribute to literature on biomechanical properties.

1.2 Problem Statement

Grip strength is commonly employed as an indicator to characterize the health and general muscle strength of the human hand. Moreover, it is also an indicator used to characterize overall upper extremity strength (Richard et al., 2006; Simard et al., 2012).

Evaluating grip and pinch strength is executed by health care workers occupational therapists and other professionals involved in hand therapy programs to determine the impact of numerous treatments and surgical approaches. The patients' capacity at the onset is used to provide grounds for which the assessment and progress of patients could take place (Harth, Services & Unfallklinik, 1994; Mullerpatan et al., 2013).

Grip strength remains to date the prominent method of evaluating the impact of treatments (Hossain et al., 2012). Care must be made to ensure that workers do not exceed strength limits of the workforce, which would eventually lead to fatigue and thus many injuries (Potvin, 2012). Normative hand strength data has a very significant usage when dealing with injuries or disease processes that affect both hands. In cases where both hands are damaged and cannot serve as a guide for each other, hand strength data can serve as a very important standard for observing hand strength (Shim et al., 2013).

Currently, there isn't a universal standards for strength norms, which is quite problematic for various design and workplace purposes. To augment the issue, anthropometric measurements vary across geographical locations, and thus grip strength norms should be developed for various nations within specified geographical areas (Ekşioğlu, 2016). In this regard, the present study is the first attempt in establishing the pinch strength norms for the adult student population within the Malaysian region. Presently, these scores are adopted from overseas (Incel et al., 2002; Mathiowetz, 1984; Mullerpatan et al., 2013) There is no local data on pinch strength values in terms of (key pinch/ lateral pinch, palmar pinch and tip to tip pinch).

Normative data for hand grip strength was first reported by Kamarul et al. (2006), who found that the overall hand grip strength of Westerners were up to 1.5 times higher than that of the Malaysian population (Kamarul et al., 2006). The study, however, did not address other anthropometric data such as the various types of aforementioned pinch grip (key pinch, lateral pinch and tip to tip pinch).

As to the best of the knowledge of researchers in the present study, no standardized, normative values for pinch grip exist for the adult Malaysian, which leads to the gap covered by the present study. The primary aim is to establish normative values for hand grip strength as well as pinch strength (including key pinch, tip to tip pinch and palmar pinch) for the adult Malaysian population.

Previously, numerous studies have investigated pinch and grip strengths and recommended that therapists find such normative data valuable, and need the data to be as accurate as possible for effective therapy.

There is a need to continually update grip and pinch strength standards, given the differences in current societal trends which may impact these variables. When updated, the data could be ensured as accurate as possible, which healthcare practitioners could use to accurately evaluate client hand function. The massive demand for smartphones and mobile technology has led to a different lifestyle led by the current populace, including everyday activities and workplace. This leads to the need to update present data since these factors impact grip and pinch strength (Fain et al., 2016).

1.3 Significance of the Study

This study provide information on grip and pinch strengths and its associated factors among Malaysians in Universiti Putra Malaysia. The present research will be helpful in determining the hand grip strength, key pinch, palmar pinch and tip to tip grips among adult Malaysian students in Universiti Putra Malaysia. This endeavor is unprecedented, and it further seeks to establish the correlation between BMI and hand grip strength for the sample population. The data obtained will be explored and compared with international hand grip strength norms. Other benefits of the normative data the study seeks to obtain are in aiding therapists to properly assess hand disorders and injuries as well as to evaluate and compare among treatment strategies and note down feedback. Health practitioners, especially nutritionists, tend to assess the nutritional status while clinicians assess some diseases such as carpal tunnel syndrome and the like among this Malaysian group.

1.4 Study Objective

1.4.1 General Objectives

To determine the hand grip and pinch strengths and its associated factors among students in Universiti Putra Malaysia.

1.4.2 Specific Objectives

The specific objectives of this study are as follows:

- i. To determine the socio-demographic characteristic (age, gender and ethnicity), Body Mass Index and hand dominance among student in Universiti Putra Malaysia.
- ii. To determine the grip strength, pinch strengths among students in Universiti Putra Malaysia.
- iii. To determine the association between socio-demographic characteristic (age, gender and ethnicity), Body Mass Index and hand dominance and hand grip strength among students in Universiti Putra Malaysia.
- iv. To determine the association between socio-demographic characteristic (age, gender and ethnicity), Body Mass Index and hand dominance and pinch grip strength among students in Universiti Putra Malaysia.
- v. To determine the association between hand grip strength and pinch grip strength.
- vi. To determine predictors for hand grip strength and pinch strength among students in Universiti Putra Malaysia.

1.5 Hypothesis

The alternate hypotheses are as follows:

- 1: There is significant association between socio-demographic characteristic (age, gender and ethnicity), Body Mass Index and hand dominance and hand grip strength among students in Universiti Putra Malaysia.
- 2: There is significant association between socio-demographic characteristic (age, gender and ethnicity), Body Mass Index and hand dominance and pinch grip strength among students in Universiti Putra Malaysia.
- 3: There is significant association between hand grip strength and pinch grip strength.



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BIODATA OF STUDENT



The student, Nancy Saad was born in Cairo, Egypt. She completed her primary and secondary education at Holy Family school, in Egypt. Upon completion her higher secondary education in 2009, she received an offer to study Bachelor of physical therapy in Cairo University and successfully graduated in September 2013.

During this time she started her career as a physiotherapist in private hospitals and clinics. In between September 2014 to March 2015, She was offered to continue her internship in Lincoln University college, Petaling Jaya Malaysia.

From March 2015, she returned back to the health field and worked as a physiotherapist for total 3 years' experience.

At present, she is pursuing her interest in the field of health science by furthering her studies in Master of Science (Orthopaedic Department), Faculty of Health and medicine science.



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