

**STUDY ON HAND GRIP ORIENTATIONS VERSUS HAND GRIP
STRENGTH FOR MALAYSIA ADULTS**

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**UNIVERSITI TEKNIKAL MALAYSIA MELAKA
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STUDY ON HAND GRIP ORIENTATIONS VERSUS HAND GRIP STRENGTH FOR MALAYSIA ADULTS

This report is submitted in accordance with requirement of the University Teknikal
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by

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DECLARATION

I hereby declare that the project work entitled “ Study on Hand Grip Orientations versus Hand Grip Strength for Malaysia Adults”, submitted to the Universiti Teknikal Malaysia Melaka for final year project, is a record of an original work done by me under guidance of Dr. Muhammad Syafiq bin Syed Mohamed, and this project work has not performed the basis for the award of any degree or diploma and similar project if any.

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Date:

APPROVAL

This report is submitted to the Faculty of Manufacturing Engineering of Universiti Teknikal Malaysia Melaka as a partial fulfillment of the requirements for the degree of Bachelor of Manufacturing Engineering (Hons.). The member of the supervisory committee is as follow:

.....

Dr. Muhammad Syafiq bin Syed Mohamed

ABSTRAK

Fisiologi berubah dan kehilangan kekuatan genggamannya adalah akibat biasa daripada proses penuaan. Kajian terdahulu telah menunjukkan bahawa fisiologi berubah akan memberi kesan kepada kekuatan genggamannya, bagaimanapun, tidak ada kajian yang telah menunjukkan hubungan antara orientasi pegangan dan kekuatan genggamannya kalangan penduduk Malaysia. Oleh itu, objektif kajian ini adalah untuk mengumpul dan mengkaji hubungan antara orientasi pegangan dan kekuatan genggamannya dalam sampel mewakili populasi di Malaysia. Sekumpulan Malaysia lelaki berusia antara 20 hingga 39 tahun telah diuji dengan Jamar dinamometer digital dengan dua perbicaraan di tangan dominan apabila pergelangan tangan dalam tiga kedudukan iaitu neutral, supination dan pronation dalam postur berdiri.

Untuk mencapai objektif kajian ini, data kekuatan genggamannya telah diambil dari 125 orang perwakilan, diambil dari Malaysia. Kemudian, analisis statistik telah dijalankan untuk mengenal pasti orientasi genggamannya yang ketara mempengaruhi kekuatan genggamannya.

Kemudian, kekuatan genggamannya tangan data daripada dominances tangan, normal dan tidak normal BMI dari segi kekuatan cengkaman serta ukuran antropometri telah dibandingkan dengan data untuk neutral, pronation dan supination postur, untuk menentukan sama ada terdapat perbezaan dalam ukuran antara kumpulan-kumpulan ini. Dapatan ini menunjukkan kepentingan untuk pereka produk untuk memahami pada perbezaan dalam ukuran fisiologi lelaki untuk mencipta produk ergonomik yang memenuhi keperluan mereka.

Sumbangan penting kajian ini adalah seperti berikut. Pertama, penemuan data kajian ini boleh digunakan untuk membina pangkalan data ukuran kekuatan genggamannya tangan untuk golongan belia lelaki di Malaysia dan telah digunakan dalam program pemulihan tangan dan antropometri kejuruteraan design seperti peralatan, tempat kerja, design produk dengan matlamat kecekapan, keselamatan dan keselesaan. . Kedua, kaedah yang telah dicadangkan dalam kajian ini yang akan berguna bagi penyelidik yang ingin mendalami pemahaman mereka mengenai hubungan antara kekuatan genggamannya tangan dan

pergelangan tangan orientasi rakyat Malaysia belia lelaki. Model regresi dimensi anthropometric dan kekuatan cengkaman dalam orientasi tangan yang berbeza telah dibangunkan dalam kajian ini boleh digunakan sebagai satu cara untuk meramalkan kekuatan gengaman tangan daripada populasi lelaki di Malaysia, yang akan membantu pereka produk dalam mewujudkan produk yang direka secara ergonomik.

ABSTRACT

Physiological changes and loss of handgrip strength were natural consequences of the ageing process. Previous studies have been shown that physiological changes will affect the handgrip strength, however, there are no studies which have developed to show the relationship between handgrip orientations and handgrip strength among Malaysian population. Hence, the objectives of this study were to collect and examine the correlation between handgrip orientations and handgrip strength in a representative sample of the youth population in Malaysia. A group of Malaysia male aged between 20 to 39 years had been tested with a digital Jamar dynamometer with two trials on dominant hand when wrist in three positions which were neutral, supination and pronation in standing posture.

In order to achieve the objectives, handgrip strength data have been collected from a 125 subjects, recruited from Malaysia. Then, a statistical analysis was carried out to identify the handgrip orientations that significantly influence handgrip strength.

Then, hand grip strength data of the hand dominances, normal and abnormal BMI in terms of grip strength as well as the anthropometric dimensions were obtained and compared with the data for neutral, pronation and supination positions, in order to determine if there is a significant difference in the measurements between these groups. This finding indicates the importance for product designers to gain an understanding on the differences in the physiological dimensions of male subjects in order to create ergonomic products that meet their needs.

The significant contributions of this study are as follows. First, the data findings of this study can be used to build a database of hand grip strength measurements for the male youth population in Malaysia and can be used in the hand rehabilitation program and engineering anthropometry design such as equipment, workplace, job design and product design with the goal of efficiency, safety and comfort of the operators and users.. Second, a methodology was being proposed in this study which will be useful for researchers who

intend to deepen their understanding on the relationship between hand grip strength and hand wrist orientations of male youth Malaysians. The regression models of anthropometric dimensions and grip strength in different hand orientations was developed in this study can be used as a means to predict the hand grip strength of the male populations in Malaysia, which will assist product designers in creating ergonomically designed products.

DEDICATION

This report is dedicated
to my beloved parents,
who educated me and enabled me
to reach at this level.

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LIST OF ABBREVIATIONS

ADL	-	Activities of Daily Living
ANOVA	-	Analysis of Variance
ASHT	-	American Society of Hand Therapists
ATP	-	Adenosine Triphosphate
BMI	-	Body Mass Index
CCOHS	-	Canadian Centre for Occupational Health Safety
CTS	-	Carpal Tunnel Syndrome
IADL	-	Instrumental Activities of Daily Living
IIUM	-	International Islamic University of Malaysia
ISO	-	International Organization for Standardization
RA	-	Rheumatoid Arthritis
SOE	-	Sincerity of Effort
UPNM	-	Universiti Pertahanan Nasional Malaysia
USA	-	United States of America
UTeM	-	Universiti Teknikal Malaysia Melaka
WHO	-	World Health Organization
WMSDs	-	Work-related Musculoskeletal Disorders

LIST OF SYMBOLS

°	-	Degree
α	-	Percentage of Relative Accuracy Desired
CV	-	Coefficient of Variation
kg	-	Kilogram
lbf	-	Pounds of Force
mmHG	-	Millimeter of Mercury
n	-	Sample Size
Nm	-	Newton Meter

CHAPTER 1

INTRODUCTION

This chapter explains the background of study, objectives, scope, problem statement and the benefit of this study. The basic fundamental of activities of the daily living will discuss in the background of this study. Problem statement will illustrate a clear vision that the problem exists in this study. The objectives and scope of this study will give details about what this study focuses on. The potential benefit of this study will be highlighted at the end of this chapter.

1.1 Background of Study

In our daily life, many function and activities that people must be capable to do routinely considered fully independent including turning a doorknob, carrying laundry, showering and vacuuming which handgrip strength is required for performance. Other than that, many daily functions and sportings like basketball, badminton, tennis and baseball also require high activities level of the flexor musculature of the hands, forearms and the muscles involved gripping strength.

According to Poliquin (2006), handgrip quality is regularly utilized as a pointer of general physical quality, hand and lower arm muscles exhibitions. At the point when human engaged with grasping exercises, there are 35 muscles associated with the development of the lower arm and hand. During holding exercises, the muscles of the flexor system in the hand and lower arm make grasp quality while the extensors of the lower arm balance out the wrist. There are four noteworthy joints of the hand, carpometacarpal, intermetacarpal, metacarpophalangeal, and interphalangeal joint, with 9 extraneous muscles that cross the wrist and 10 characteristic muscles with both of their connections distal to the wrist. These muscles incorporate the

pronator radii teres, flexor carpi radialis, flexor carpi ulnaris, flexor sublimis digitorum, and Palmaris longus on the outward layer and the flexor profundus digitorum, flexor pollicis longus, pronator quadratus, flexor pollicis brevis, and abductor pollicis brevis on the inherent layer. Each of these muscles is dynamic amid holding exercises.

Hand grip strength is different depends on their hand size, age, gender, body size, arm and calf circumferences, dominance hand and health condition. As an assessment measure hand grip strength has been appeared to have predicted all kinds of morbidities and mortalities of middle and old age, also helps to predict the disability and health condition which related quality of life.

In our country, handgrip strength has widely used the test in experimental studies in young healthy individuals (Adedoyin et al., 2009: Kaur, 2009: Rowlands & Roberts, 2007). The relationship between hand span and handgrip is hand span is correlated with grip span and handgrip strength is impacted by hand span, which infers the requirement for an adjustment of the grip span of hand dynamometer to the hand span. So there will be an adjustment of grip span during the grip strength measurement according to hand size. Since men are the most important source of the workforce, their handgrip strength and anthropometric data are necessary for ergonomic considerations, Liao (2014) has a study has been undertaken to generate handgrip strength and hand span of healthy Malaysia youth male to determine whether these parameters are correlated.

1.2 Problem Statement

There are studies in explaining the relationship of socio-statistic factors by various age, sexual orientation, body size and morals with handgrip quality. There are some comparative researches on factors that affected handgrip quality, which is hand predominance, height, tallness and weight have likewise been done on Malaysian populace (Kamarul et al., 2006 & Hossain et al., 2012). Comparing the studies among Asian and Western populaces demonstrate the investigations utilizing Western-based information do not really apply to Malaysian populace as announced.

Those studies reasoned that Western standard of handgrip quality estimation and Asian individuals were diverse since the hand size of Asian were marginally smaller than Westerners.

Additionally, there are numerous studies which have been done to check the relationship or example, statistical factors with handgrip quality and there are absence of proof to demonstrate the connection amongst socioeconomics and hand anthropometric measurements.

Therefore, the study is needed due to the lack of study in the Malaysian population. The main point of this study is to investigate the relationship between handgrip strength and handgrip orientations of dominant hand in standing posture. And this study is focused on Malaysia male youth population only. In the process of this investigation the handgrip strength, hand gripping system is designed for Asian hand size.

Handgrip strength would be affected by the forearm position when the subjects are gripping due to the biomechanical properties of the forearm and hand muscles. This study will examine the effect on grip strength of different positions of forearm as neutral, supination and pronation while maintaining the standard position recommended by the Southampton protocol.

In addition, this study is helpful for post hand surgery recuperation following. For instance, a carpal passage disorder patient will experience recovery procedure to recapture their hold quality and continuance back to his or her unique level however the genuine level can't be resolved since the patient who conceded for surgery has a bargained handwork. Because of that inspiration, the model of handgrip quality is expected to foresee his or her typical level of hold quality in light of Asian populace.

1.3 Objective

By referring problem statement, the objectives of the study are listed as follows:

- To collect handgrip strength data among young Malaysia male population.
- To identify descriptive statistical trend of grip strength for different hand positions.
- To analyze the relationship between handgrip strength data versus different hand orientations among young Malaysia male.

1.4 Scope of Study

The scope of the study is around 125 male aged between 20-39 years old in a standing posture to measure the maximum handgrip strength when the wrist orientations at neutral, supination and pronation. Measurement of maximum handgrip strength will be performed using Jamar hand dynamometer.

1.5 Benefit of Study

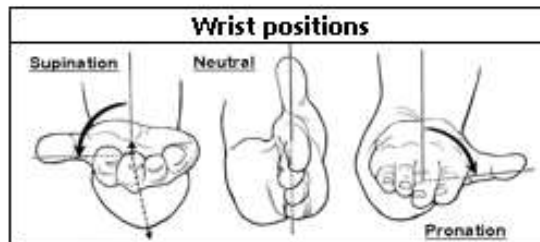


Figure 1.1: Wrist positions will be measured in this study (TennisWarehouse, 2015).

This study gives a reference about the handgrip strength data of Malaysia male youth to be used in the hand rehabilitation program and engineering anthropometry design such as equipment, workplace, job design and product design with the goal of efficiency, safety and comfort of the operators and users. On the other hand, the data obtained through this project also can be referred by occupational therapists and physiotherapists. Lastly, this study gives a reminder to the younger age population to be alert and concern with the activities of daily living to maintain their health and ability in older age.

CHAPTER 2

LITERATURE REVIEW

This chapter contains the literature review which related to the scope of the study. It covers various sources of the important elements with a view to enrich the literature with more relevant information such as definition, methods, protocols/ procedures that can be used in this project. The sources of information are obtained from articles, journals and website.

2.1 Hand Grip Strength

2.1.1 Overview

According to Bhuanantanondh et al. (2017) and Cha et al. (2014), hand represents a significant role as a musculoskeletal tool to perform and complete daily operations, tasks and working activities. Hence, handgrip strength is an important component in these evaluations as work-related musculoskeletal disorders of the hand and wrist. The measure of force required to utilize a hand tool and its relationship to the user's ability to apply this force is a critical design criterion of hand tools, regularly influencing the immediate safety of the tool user and the propensity of the tool to cause injury to the user with long-term use. Because the wrist is often put in deviated positions, the accessible information on grip strength with an undeviated wrist configuration may not be applicable to the design objective of many hand tools, hence, this study demonstrates decreases in handgrip strength due to wrist deviations and forearm rotation (Guimaraes et al., 2017).