ASSESSMENT OF THE HAND GRIP STRENGTH AND HAND INJURIES FOR UTEM SPORTSPERSON

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Assessment of the Hand Grip Strength and Hand Injuries for UTeM Sportsperson

This report submitted in accordance with requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor Degree of Manufacturing Engineering Management (Hons.)

by

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ABSTRAK

Kajian ini adalah mengenai prestasi lengan dan cengkaman tangan atlet Malaysia dan hubung kaitnya dengan kecederaan lengan dan tangan. Atlet ini telah dibahagikan kepada beberapa jenis kumpulan yang berbeza dan dibahagikan mengikut jantina masing-masing. Lelaki dan Perempuan biasanya mempunyai norma kekuatan lengan dan cengkaman tangan yang berbeza. Golongan atlet biasanya mempunyai kekuatan cengkaman tangan yang lebih baik berbanding dengan orang biasa. Data untuk kekuatan cengkaman tangan atlet Malaysia diambil menggunakan kajian soal selidik dan dinamometer. Data ini kemudian diproses menggunakan perisian SPSS. Kajian ini membantu kita untuk menentukan hubungan di antara kecederaan lengan dan tangan atlet Malaysia dengan sukan yang mereka ceburi. Atlet ini terdedah kepada kecederaan tangan dan lengan yang berbeza kerana mereka dilatih dengan cara yang berbeza mengikut sukan yang mereka terlibat. Atlet Malaysia seharusnya selesa di dalam sukan yang mereka ceburi dan juga harus mengelak sebarang kecederaan tangan dan lengan pada masa akan datang. Kajian ini juga boleh membantu kita untuk meningkatkan kecekapan prestasi atlet Malaysia pada masa akan datang.

ABSTRACT

This study is about the performance of arm and hand functions of Malaysian athletes and its relationship to the arm and hand injuries. The athletes are divided into a few different groups and mainly are divided according to their gender. Male and female have different hand grip strength norms. Athletes usually have better hand grip strength compared to normal people. The data for Malaysian Athletes hand grip strength are collected using the dynamometer and questionnaires. It is then processed using the SPSS software. This study helps us to determine the relationship between the hand and arm injuries with the sports that the Malaysian athletes are involved with. Different athletes are exposed to different type of hand and arm injuries since they are trained well in different hand grip types according to the sports they are involved in. These athletes should be comfortable with their sports and should avoid hand and arm injuries in the future. This study may also helps to increase the efficiency of Malaysian athletes' performance in the future.

DEDICATION

To my beloved mother, father, friends and especially to my engineering master, my late brother Bustamyudin Bin Yaman, thank you for the support and encouragement.

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LIST OF ABBREVIATION, SYMBOLS AND NOMENCLATURE

CTS	-	Cumulative Trauma Disorder
ODBC	-	Open Database Connectivity
OOS	-	Occupational Overuse Syndrome
RMS	-	Repetitive Motion Syndrome
RSI	-	Repetitive Strain Injury
SPSS	-	Statistical Package for Social Sciences

CHAPTER 1
INTRODUCTION

1.1 Background

Malaysian athletes need to be good at fitness strength and coordination efficiency. A lot of manual hand grip strength and dexterity tests are created to assess the efficiency. These tests are usually not accurate and need to be done repeatedly. The hand grip strength is the force applied by the hand to pull on an object and is a specific part of hand strength. Stair rails are an example of where shape and diameter are critical for proper grip in case of a fall. Other grip strengths that have been studied are the baseball bat and other hand tools. In applications of grip strength, the wrist must be in a neutral position to avoid developing cumulative trauma disorders (CTD's).

A cumulative trauma disorder is a condition where a part of the body is injured by repeatedly overusing or causing trauma to that body part. Trauma occur when the body part is called on to work harder, stretch farther, impact more directly or otherwise functions at a greater level then it is prepared for. The immediate impact may be minute, but when it occurs repeatedly the constant trauma cause damage. The term cumulative trauma disorder identifies a large group of conditions that result from traumatizing the body in either a minute or major way over a period of time. It is the build up of trauma that causes the disorder. These conditions are often focused on a joint and usually affect the muscle, bone, tendon or bursa of the joint. However other anatomical features and areas can be stressed and their response to that trauma can be an injury.

Most studies evaluating the usability of the hand grip force match procedure have been conducted in a controlled laboratory environment (Bao and Silverstein, 2005; Koppelaar and Wells, 2005; Marshall et al., 2004). These studies have explored volunteers' ability to replicate specific hand force levels (King and Finet, 2004; umar et al., 1997; Lowe, 1995). Results have varied regarding the accuracy and precision of force matching when compared to known forces in instrumented handles or tools (Koppelaar and Wells, 2005). Despite limited testing of the force match procedures in field studies, the methods are commonly used to collect hand force information for prevention and intervention studies. In this study, dynamometer and questionnaires are used to collect the data. This study also evaluated the validity of the relationship of the hand grip force with the hand and arm injuries.

1.2 Problem Statement

The performance of arm and hand function may be used to identify the efficiency of humans. In this study, it is to identify the performance of arm and hand functions of UTeM athletes and its relationship to the arm and hand injuries. Different group of athletes are exposed to different type of hand and arm injuries since they are trained in different hand grip type according to the sports they are involved in. The aim of this study is to evaluate the hand grip and dexterity for UTeM sportsperson and to compare the relationship between their hand grip strength with the hand problems or syndrome.

This study emphasis on sportsperson as they are trained well and have better hand grip strength compared to normal people. These people tend to be more invincible to hand and arm injuries and in the other hand may be the most potential type of people who are exposed to hand and arm injuries if they are trained excessively and not properly.

To attack this problem, I have to collect some data from different type of UTeM athletes' categories. First of all, I have to prepare a questionnaire for written assessment and a dynamometer for the physical test. The questionnaire is created to

extract information on the specific body part which will lead to the hand and arm injuries and at the same time are able to get to know the participants background. The data then will be collected and processed using the Microsoft Excel. The software is very helpful to relate the target group data with the hand and arm injuries.

1.3 Objective

This study has a few objectives to accomplish. Each of the objectives will be encountered using the appropriate method that will be explained more in chapter 3. The aim of this study is divided into 3 parts as follow:

1. To identify significant relationships between hand grip strength of hand and general hand and arm injuries.
2. To evaluate the hand grip strength for UTeM sportsperson.
3. To investigate the hand pain experience for UTeM sportsperson.

1.4 Scope of study

The scopes of the study justify the participants for this study. In general, this study is on the UTeM sportsperson. As we all know, sportsperson are usually expert and well trained for one type of sport. Different sportsperson have different expertise in their hand grip strength. The scope of this study is divided into 5 categories. There are as below:

1. Male and female UTeM badminton athletes.
2. Male and female UTeM handball athletes.
3. Male and female UTeM Kayak athletes.
4. Male and female UTeM Softball athletes.
5. Male UTeM Rugby athletes.

1.5 Report Outline

This report is written in 3 chapters. This is the first chapter which describes generally on what the whole study is all about. The first chapter includes study background, objectives and scopes. The second chapter is on the literature review. It elaborates more on hand grip and the disease may occur from it. Here the types of grips are explained more with illustrations. Other than that, it also describes on various types of hand arm and injuries and also the software that will be used. Next is chapter 3 which is the methodology. In this chapter we can see the overall flow of the study. The data collection methods are explained here. The Gantt chart is also in this chapter to show the study planning and the actual time taken. In chapter 4, the data obtained are analyzed here. Graphs and tables are drawn out to show the overall result of my study. Each category will be evaluated respectively. The last chapter is chapter 5. This chapter conclude this study and state out any recommendations.

CHAPTER 2
LITERATURE REVIEW

This Chapter discusses on manual hand grip assessment and injuries may occur from it. The assessment or test is subjective and need to be done a few times to get the most accurate result. This study is more on UTeM athletes including male and female.

2.1 Hand Grip

There are 35 muscles involved in movement of the forearm and hand, with many of these involved in gripping activities during gripping activities; the muscles of the flexor mechanism in the hand and forearm create grip strength while the extensors of the forearm stabilize the wrist (Waldo, B. Grip Strength Testing, 1996). There are four major joints of the hand, Carpometacarpal, Intermetacarpal, Metacarpophalangeal, and interphalangeal joint, with 9 extrinsic muscles that cross the wrist and 10 intrinsic muscles with both of their attachments distal to the wrist (Hall S. Basic Biomechanics, 2007). These muscles include the pronator radii teres, flexor carpi radialis, flexor carpi ulanris, flexor sublimis digitorum, and Palmaris longus on the extrinsic layer and the flexor profundus digitorum, flexor policus longus, pronator quadratus, flexor pollicus brevis, and abductor pollicus brevis on the intrinsic layer. Each of these muscles is active during gripping activities.

According to German Sports Scientist Jurgen Weinick, the characteristic structure of the hand is related to its function as a grasping tool. Grasping ability is made possible by the

fact that the thumb can be opposed to the fingers. The fingers and the thumb act as a versatile pair of pliers. They need the palm of the hand as a flat base, on which the object grasped can be held (Weinick J. Functional Anatomy in Sports, 1990). From this statement, it can be concluded that the anatomy of the hand is more geared toward flexion than extension. Further proof lies in the research of Li, Zatsiorsky, and Latas on the strength of finger flexor vs. finger extensor musculature during isometric tasks. Their findings revealed the flexor mechanism of the fingers to be 62% stronger than the extensor (Li Z., Zatsiorsky V., Latash M, 2001)

Figure 2.1: Hand Muscles

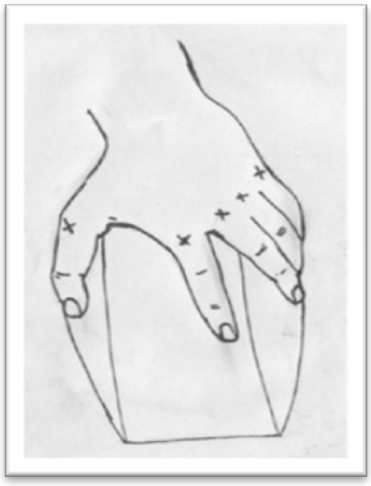
2.2 Hand Grip in Sports

A sportsperson or athletes is a person trained to compete in a sport involving physical strength, speed or endurance. Sportsperson may be professional or amateur. Most professional sportsperson have particularly well-developed physiques obtained by extensive physical training and strict exercise accompanied by a strict dietary regimen.

Hand grip is an important, though often overlooked, component of strength in sports. However, the grip strength is most often a secondary or auxiliary function of the sport. The hand is an amazing human instrument, and can be used to grip object in several ways. These different ways, and different types of grip strength, are typically quantified

based on the way the hand is being used. Following are the table of the types of hand grip.

DESCRIPTION	FIGURES
Crush Grip The crush grip is what is most commonly thought of as "grip". It involves a handshake-type grip, where the object being gripped rests firmly against the palm and all fingers.	
Pinch Grip In a pinch grip, the fingers are on one side of an object, and the thumb is on the other. Typically, an object lifted in a pinch grip does not touch the palm. This is generally considered a weaker grip position. The pinch grip is used when grabbing something like a weight plate or lifting a sheet of plywood by the top edge.	

Support Grip A support grip typically involves holding something, such as the handle of a bucket, for a long time. A great deal of muscular endurance is necessary to have a good carrying grip.	
Wrist Strength The wrist strength doesn't necessarily impact finger and grip strength. Strong wrists are an essential part of development of the forearm.	

Power and Precision Grip A precision grip is used to hold a nail or a pencil, which uses smaller and weaker finger muscles. The item is held between your thumb and index finger. This grip should not be used for tools or actions that require force. A power grip is used to hold a hammer, for example, which uses relatively strong muscles in the forearm. Your whole hand wraps around the handle.	

Table 2.1 : Types of Hand Grips

2.3 Sports and the Equipments which are related to Hand Grip

Hand grip is important to most sports such as touch football, golf, tennis, weight lifting, bowling, lawn bowls, hockey, basketball, softball, baseball, cricket, squash, badminton, volleyball and darts. The equipments used for these sports are such as bats, rackets, clubs, gloves and sticks.

Figure 2.2 : Sports Equipment

2.3.1 Hand Grip Test

Quantification of the forces applied with or by hand tools can be a difficult but important component of an ergonomic evaluation. An ergonomic evaluation should include estimates of the force requirements and the repetitiveness of the task being analyzed. Grip is critical to many daily activities; grip strength is often used in clinical settings as an indicator of overall physical strength and health. Many professions rely on grip strength to perform. For example, the admission process for fire departments, police departments, and the military may require applicants to pass a grip test.

Numerous studies indicate a strong correlation between upper extremity CTD and forceful exertions. The effect are more severe, if forceful exertions are accompanied by high frequency and awkward postures. Excessive grip force exertion is one of the most important factors contributing to the occurrence of upper CTDs, in addition to reducing workers' productivity.