

**UNIVERSITI TEKNOLOGI MARA**

**DEVELOPMENT, VALIDITY AND  
EFFECTS OF PARAPLEGIA  
FITNESS INTEGRATED TRAINING  
(PARAFIT) PROGRAM TO  
INCREASE PHYSICAL ACTIVITY  
AND FITNESS IN INDIVIDUALS  
WITH SPINAL CORD INJURY**

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Thesis submitted in fulfillment  
of the requirements for the degree of  
**Doctor of Philosophy**  
**(Physiotherapy)**

**Faculty of Health Science**

**February 2022**

## ABSTRACT

Individuals with spinal cord injury (SCI) have low levels of physical activity (PA), exercise self-efficacy (ESE), physical fitness, and adherence to exercise. Secondary complications such as cardiovascular disease, diabetes, and obesity may occur as a result of these factors. Therefore, there is a need to develop a program to enhance active lifestyle after SCI. This study aims to develop an exercise program and education tool called Paraplegia Fitness Integrated Training (PARAFiT) and examine its effects on the level of PA, ESE, physical fitness, and adherence to exercise. The development consisted of phase I (validity of the study) and phase II (the experimental study). The non-randomized controlled trial study was designed for wheelchair-bound SCI individuals whereby the participants ( $n=44$ ) were non-randomly assigned to either an intervention group (PARAFiT combined with conventional physiotherapy) or control group (conventional physiotherapy alone) with 22 participants in each group. Participants in the PARAFiT group ( $n=19$ ) and control group ( $n=20$ ) completed their involvements in the 16-week experiment. The Physical Activity Scale for Individuals with Physical Disabilities (PASIPD) and the Exercise Self-Efficacy Scale (ESES) were utilized to measure the level of PA and ESE respectively at baseline, 8<sup>th</sup> week, 12<sup>th</sup> week, and 16<sup>th</sup> week. The physical fitness outcome for cardiorespiratory fitness, shoulder strength and hand grip strength utilized the 6 Minute Push Test (6-MPT), BIODEX isokinetic machine, and JAMAR® handheld dynamometer respectively at the 4<sup>th</sup> week and 8<sup>th</sup> week. The exercise adherence was monitored throughout the program using an exercise diary. In phase I, the development shows that the program was consisted of five topics such as (1) The types of PA and exercise (2) The benefits of PA and exercise (3) Coping strategies (4) Formulation of goal settings (5) The risk and safety. The content experts also stated the education material was 75% valid to be able to increase the PA level after SCI. The pilot study was shown that the PARAFiT program was safe and highly adhered by the consumers. In phase II, the results of the 2-way repeated measure mix ANOVA showed no significant differences in PA ( $p = 0.356$ ) but significant in ESE ( $p = 0.001$ ) levels between the intervention and control groups from baseline to week 16<sup>th</sup>. The cardiorespiratory fitness also shows significant differences ( $p = 0.013$ ) from baseline to week 8<sup>th</sup>. For muscle strength, there was significant improvement for the right shoulder muscles including the external rotator, internal rotator, abductor, adductor, extensor, and flexor (all  $p < 0.05$ ) from baseline to week 8<sup>th</sup>. There were also significant differences between the intervention and control groups for left shoulder muscles such as the external rotator, internal rotator, abductor, adductor, extensor, and flexor (all  $p < 0.05$ ) from baseline to week 8<sup>th</sup>. The right hand ( $p = 0.045$ ) and left hand ( $0.043$ ) grip also showed a significant difference compared to the control group from baseline to week 8<sup>th</sup>. The intervention group (80%) and control group (75%) both demonstrated high exercise adherence during the supervised period (baseline to week 8<sup>th</sup>). However, the adherence was low during the unsupervised period for both the intervention group (40%) and control group (20%) from week 8<sup>th</sup> until week 16<sup>th</sup>. Overall, the PARAFiT program is safe to be conducted in a clinical setting and is able to enhance the PA, ESE levels, physical fitness, and exercise adherence of individuals with SCI. Future studies should incorporate guidelines for home-based exercises and regular monitoring to promote long term adherence to PA among individuals with SCI.

## **ACKNOWLEDGEMENT**

In the name of Allah, the Most Gracious and the Most Merciful. Alhamdulillah, all praise to Allah for the strength and blessing for me to complete this long and challenging journey. My gratitude and thanks go to my supervisor, Associate Prof Dr. Haidzir Manaf for his supervision, constant support, and motivation throughout my Ph.D. journey. His invaluable help in the form of constructive comments and suggestions throughout the experimental and thesis works have contributed to the success of this research. In addition, not forgetting my co-supervisor Assoc. Prof. Maria Justine and Prof. Nazirah Hasnan for their support and contribution of knowledge for this topic. My deepest gratitude goes to my beloved parents, Mr. Noor Hisham Ramlan and Mrs. Pauziah Md. Basir, my beloved wife, Nasiha Shakina Sharifuddin, my children, and my in-laws for their continuous support, understanding, and prayers. My acknowledgment also goes to the Pusat Rehabilitasi PERKESO team, Dr. Hafez Hussain, Dr. Ong Kuo Ghee, Mr. Tan Eng Wah, Mdm. Norhayati Abd Hadi, Muhammad Amin A. Razak, Hanisa Mazalan, Aw Yong, and all the staff there. This research would be not possible without their help and cooperation. My sincere thanks are extended to all the lecturers from the physiotherapy department and also the faculty of Health Sciences, University Teknologi MARA (UiTM) for their constructive comments and feedback regarding this research. Last but not least, to those who are not directly involved in this research, your kindness means a lot to me. Thank you very much. Alhamdulillah.

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# CHAPTER ONE

## INTRODUCTION

### 1.1 Research Background

#### 1.1.1 Introduction to Spinal Cord Injury

Spinal Cord Injury (SCI) can be defined as damage to the spinal cord due to traumatic events such as road traffic accidents or non-traumatic events including diseases or degeneration (World Health Organization, 2013). Injuries to the spinal cord result in altered conduction of the motor and/or sensory signals below the site of the lesion. Depending on the location of the injury, injuries can be classified as tetraplegia or paraplegia. Injury at C<sub>1</sub> to C<sub>8</sub> may result in upper and lower limb paralysis (tetraplegia) whereas injury from T<sub>1</sub> and below may lead to trunk and lower limb paralysis (paraplegia) (Tweedy et al., 2017).

The severity of SCI is primarily reflected in the level of impairment, defined by the extent of paralysis, loss of sensation, and resultant disability below the level of injury. The American Spinal Injury Association (ASIA) defined a complete injury as the absence of sensory and motor function in the lowest sacral segments. An incomplete injury is when there is partial preservation of sensory and motor function below the level of the lesion including the lowest sacral segment (Harvey, 2016; Tweedy et al., 2017). Hence, SCI may cause many disabilities and dysfunctions to an individual, which in turn may affect their daily living, function, and quality of life (QOL).

#### 1.1.2 The Prevalence of Spinal Cord Injury

##### *1.1.2.1 Worldwide*

Approximately 40 to 80 cases of SCI occur per million population each year (World Health Organization, 2013). Approximately 250,000 to 500,000 individuals suffer from SCI yearly. Global Burden Diseases stated that the occurrence of SCI in 2016 was nearly 900,000 (James et al., 2019). In total, there was a prevalence of 27 million SCI cases out of the 7 billion world population from 1990 to 2016. Therefore, the approximate occurrence of SCI is at 3.9% (James et al., 2019). However, there was