

**INVESTIGATING HEALTH RELATED FITNESS LEVEL AMONG
DOWN SYNDROME IN KELANTAN**

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**INVESTIGATING HEALTH RELATED FITNESS LEVEL AMONG
DOWN SYNDROME IN KELANTAN**

By

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CERTIFICATE

This is to certify that the dissertation entitled

INVESTIGATING HEALTH RELATED FITNESS LEVEL AMONG DOWN SYNDROME IN KELANTAN

is the bona fide record of research work done by

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DECLARATION

I hereby declare that this dissertation is the result of my own investigations, except where otherwise stated and duly acknowledged. I also declare that it has not been previously or concurrently submitted as a whole for any other degrees at Universiti Sains Malaysia or other institutions. I grant Universiti Sains Malaysia the right to use the dissertation for teaching, research and promotional purposes.

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LIST OF ABBREVIATIONS

VO_{2max}	maximal volume of oxygen
PA	Physical Activities
DS	Down Syndrome
ID	Intellectual Disability
BMI	Body Mass Index
JKM	Jabatan Kebajikan Masyarakat
WHO	World Health Organization
HR	Heart rate
ACSM	American College Of Sport Medicine
CBR	Community Based Rehabilitation
CDC	Centers for Disease Control and Prevention
BF%	Body Fat Percentage

**MENKKAJI TAHAP KECERGASAN FIZIKAL BERKAITAN KESIHATAN
DALAM KALANGAN SYNDROM DOWN DI KELANTAN.**

ABSTRAK

Syndrom Down (DS) ialah satu kategori kurang upaya intelektual yang dikaitkan dengan kecacatan dalam kromosom 21. Individu yang menghidapai DS diketahui umum mempunyai tahap kecergasan fizikal yang rendah berbanding dengan rakan sebaya yang tipikal. Malah kajian juga mendapati tahap kecergasan individu DS, secara umumnya lebih rendah dari individu kurang upaya intelek dari kategori yang lain. Tahap kecergasan yang rendah ini, boleh mengganggu kesihatan dan memberi kesan negatif kepada kualiti hidup individu DS.

Kajian ini dijalankan untuk mengkaji tahap kecergasan dalam kalangan syndrome down di Kota Bharu Kelantan. Seramai dalam 16 orang peserta syndrome down dari Pusat Pemulihan Dalam Komuniti (PDK) dan Persatuan Sindrom Down, Negeri Kelantan (PSDNK) telah menyertai kajian. Ujian tahap kecergasan fizikal seperti jisim indek badan (BMI), peratusan lemak badan, ujian berjalan kaki Rockport (Rockport walking test), ujian tekan tubi, ujian bangkit tubi , ujian genggam tangan dan ujian duduk dan mengjangkau telah dijalankan.

Kajian ini mendapati tahap kecergasan DS adalah rendah, tetapi bacaan jisim indeks badan (BMI) dan peratusan lemak badan adalah tinggi. Dapatan ini menggambarkan bahawa keadaan tahap kecergasan berkaitan kesihatan DS dalam kajian ini adalah pada tahap tidak sihat. Oleh itu, keperluan penglibatan DS secara aktif dalam aktiviti fizikal adalah penting bagi mengurangkan risiko penyakit tidak berjangkit (NCD) seperti kencing manis, darah tinggi dan penyakit jantung.

INVESTIGATING HEALTH RELATED FITNESS LEVEL AMONG DOWN SYNDROME IN KELANTAN

ABSTRACT

Down syndrome (DS) is a category of intellectual disabilities which is associated with abnormalities in chromosome 21. Individuals with DS have lower physical fitness levels compared to their typical peers. Furthermore, research also states that their level of physical fitness are generally lower than individuals with intellectual disabilities from other categories. The low level of physical fitness may affect their health and may negative affect their quality of life.

This study was conducted to investigate the fitness level among Down syndrome in Kelantan. There were 16 Down syndrome participants from Community Based Rehabilitation (CBR) and Kelantan Down Syndrome Association (PSDNK) participated in this study. The physical fitness levels such as body mass index, body fat percentage, Rockport 1-mile walking test, sit-up test, curl up test, hand grip test as well as sit-and-reach test have been conducted.

The study found that the health related physical fitness levels of DS was low, conversely, the body mass index and body fat percentage are high. These findings indicating that the health related fitness of DS in this study are not healthy. Therefore, it is imperative for the DS to actively participate in physical activities in order to reduce the risk of having non-communicable diseases (NCD) such as diabetes, hypertension or heart diseases.

CHAPTER 1: INTRODUCTION

1.1 BACKGROUND OF STUDY

Down syndrome (DS) is a condition of intellectual disability and associated with abnormalities in chromosome 21. World Health Organization (2018) estimated incidence of Down syndrome is between 0.0009 - 0.001 live births worldwide (1 in 1000 – 1100 live births). Each year approximately 3,000 to 5,000 children are born with this chromosome disorder and it is reported that there are about 250,000 families in the USA who are affected by Down syndrome. The incidence of Down Syndrome in Malaysia is higher than the WHO estimations. Hoe *et al.*(1989) reported that the incidence of Down syndrome in one of the largest government hospitals in Malaysia was 1:959 of life birth. Another report by Liza-Sharmini *et al.* (2006) stated that the incidence of Down Syndrome among various ethnicities was 1:981, 1:940 and 1:860 live births in Malay, Chinese and Indian populations respectively.

Glasson *et al.* (2002) reported that the life expectancy of this population has increased significantly, from only 12 years in 1940 to 60 years in the present day and average lifespan is still lower than that of the general population. Bittles *et al.* (2007) stated that the cause of death in Down syndrome population was respiratory diseases, congenital diseases, cardiovascular diseases and cancer. Pueschel (1990) reported that there are more than 80 medical condition characteristics that are commonly associated with DS such as

congenital heart disease and mitral valve prolapse. As Pitetti *et al.* (1993) reported that some of the clinical characteristics of Down Syndrome are muscle hypotonicity and hypermobility of the joints or ligamentous laxity.

It is very important to understand different health issues among DS to develop health promotion strategies in the future. Physical fitness is a set of attributes that people have or achieved. Being physically fit has been defined as "the ability to carry out daily tasks with vigor and alertness, without undue fatigue and with ample energy to enjoy leisure-time pursuits and to meet unforeseen emergencies (Park, 1989). Fitness is divided into health and skill related components. Health-related physical fitness is a measure of a person's general physical wellbeing. It is comprised of five different components: cardiorespiratory endurance, muscular strength, muscular endurance, flexibility, and body composition (Ayers & Sariscsany, 2011).

All five of these components are directly related to one's health and quality of life. Every individual needs a minimum level of each component in order to perform regular daily living activities. Ayers and Sariscsany (2011) stated that higher level of health-related fitness also decreases the risk for cardiovascular disease and other diseases and can promote physical, social, and emotional health.

People with DS are often living in a sedentary lifestyle. Sedentary lifestyle may lead to health problem including obesity, hypertension, low back pain, osteoporosis, coronary heart disease, diabetes, colon cancer, anxiety and depression, and premature mortality due to inactivity. To reduce cardiovascular disease and mortality from all causes, development cardio-respiratory fitness is recommended (Kodama et al. 2009). However, DS have lower cardio-respiratory fitness levels compared to their peers without DS, which affect in their health and quality of life (Gonzalez et al., 2010). Several western investigators have studied about physical level among down syndrome and their result showed that both youths and adults with DS have lower levels of cardiovascular fitness compared with matched controls without DS (Fernhall et al., 2001; Guerra et al., 2003).

Studies on Down syndrome children found that they are living in sedentary lifestyle and spent more time indoors compared with their siblings without Down syndrome (Sharav & Bowman, 1992). Low levels of physical fitness may induce functional deterioration due to an increase in the prevalence of overweight or obesity, as well as reduction in bone mass development, which may ultimately result in the aggravation of their clinical manifestations. There was no report about Down syndrome study in Malaysia. Therefore, the present study was proposed to investigate the physical fitness level among Down syndrome.

1.2 WHAT IS COMMUNITY BASED REHABILITATION

Community-based rehabilitation (CBR) is a strategy within community development for the rehabilitation, equalization of opportunities and social integration of all children and adults with disabilities. CBR is implemented through the combined efforts of disabled people themselves, their families and communities, and the appropriate health, education, vocational and social services (World Health Organization, UNESCO & International Labour Organization, 1994).

Community-based rehabilitation (CBR) promotes collaboration among community leaders, people with disabilities, their families, and other concerned citizens to provide equal opportunities for all people with disabilities in the community. World Health Organizer (1994) mention that CBR promotes the human right of people with disabilities through changes within the community and improve quality of life of person with disability. The concept of CBR has changed and is now aiming at addressing all areas that are essential for the quality of life of persons with disabilities and the building of inclusive societies.

1.3 THE IMPORTANCE OF PHYSICAL FITNESS

While some diseases cannot be prevented, but some could be prevented by reducing the risk from having the diseases such as life-style related diseases (Non-Communicable Disease – NCD), such as diabetic, hypertension and heart diseases. It could be prevented by practicing healthy lifestyle and engaging in regular physical activities.

In a study reported by Blair *et al.* (1989), who conducted a study among 10, 224 men and 3120 women. It was reported that physical activity and physical fitness could be predictors of death. Regular exercise and physical activity promotes strong muscles and bones. It improves respiratory, cardiovascular health, and overall health. Staying active can also maintain a healthy weight, reduce risk for type 2 diabetes, heart disease, and reduce your risk for some cancers. The importance of physical activities is also applicable to people with Down Syndrome.

1.4 PHYSICAL ACTIVITY AND DOWN SYNDROME

Physical inactivity is one of the ten leading risk factors for worldwide mortality (Vouri, 2004). Lack of physical activity is the main risk factor for type II diabetes, hypertension, overweight and obesity problems. Similarly, physical activity and exercise is important for individuals with Down syndrome.

Physical activities can promote well-being of body, mind, and reduce chronic disease (Biddle, 2000) and provide psychological benefits (Gignac, M.A.M 2003). Physical activity enhance the cardiovascular fitness (Vicente-Rodriguez et al., 2005), it contributes to a healthier lifestyle (Stewart et al., 2003), and it may enhance the antioxidant defense system (Franzoni et al., 2005) which delays cell aging.

General fitness level of Down Syndrome (DS) is reported to be low (Jobling, 1994). The lower fitness level among DS was partly due to the syndrome-specific conditions, such as heart problems. Individuals with DS have a tendency to become obese. Issues of overweight and obesity are influenced by lack of physical activities and poor diet. This study may provide information on the health related physical fitness level among Down syndrome in Kelantan.

1.5 BARRIERS TO PHYSICAL ACTIVITY AMONG INDIVIDUALS WITH DOWN SYNDROME.

Many Individuals with Down syndrome (DS) do not take part in daily physical activities. There are several factors that hinder individuals with Down syndrome from taking part in physical activity. Health problem such as obesity, heart disease .muscle hypotonicity, joint hypermobility as well as parental concerns about the safety of the physical activities. Lack of physical activities in DS increases the tendency for obesity or overweight.

1.6 RESEARCH QUESTION

Person with Down syndrome (DS) have poor physical state due to clinical features such as muscular hypotonia, prevalence of heart and pulmonary disease, circulatory system abnormalities, hyper mobility of the joints or ligamentous laxity. So, DS tendency to become obese. There is factor become obesity or over weight was physical inactivity and poor diet but it seems also that there is a lack of expectations in programming. There have previous study of Gonzalez *et al.* (2010) mention that DS have lower cardio-respiratory fitness levels compared to their peers without DS, which can negatively interfere in their health and quality of life. Physical activity improves well-being of body, mind, and reduce cardiovascular disease .It also encourage bones development, improves movement, balance and coordination skills. Additionally, physical activity develops social skills DS children to be independent, concentration, academic performance and self-esteem. Physical activity could be potential factors in helping DS improve their quality of life.

According to Cruz et al., (2007) stated that physical inactivity is one of the main risk factor that lead to unhealthy health status and can also increase the risk of cardiovascular disease (CVD) such as heart attack and stroke. Therefore, it is necessary to investigate what is the level of health related fitness among people with Down syndrome.

1.7 RESEARCH OBJECTIVES

To investigate health related fitness level among Down syndrome in Kelantan.

1.7.1 GENERAL OBJECTIVE

The general objective of this study is to explore the health related fitness level among Down syndrome in Kelantan.

1.7.2 SPECIFIC OBJECTIVES

1. To investigate the cardiovascular fitness level among male and female down syndrome.
2. To investigate the muscular endurance among male and female down syndrome.
3. To investigate the flexibility among male and female down syndrome.
4. To investigate the muscular strength among male and female down syndrome
5. To investigate the Body mass index (BMI) and body fat percentage among male and female Down syndrome.

1.8 SIGNIFICANCE OF THE STUDY

Health related fitness is a strong indicator of health status. Generally, person with Down syndrome is associated with poor health related fitness. However, no information is available in Malaysian context. Hence this investigation would provide some information about the status of health related fitness among people with Down syndrome in Kelantan. The information may enable the relevant authorities to design appropriate intervention programs to promote healthy life style among people with Down syndrome and improve their health status. The study may also provide some ideas for future research, considering the scarcity of research reports in this aspect.

CHAPTER 2: LITERATURE REVIEW

2.1: PHYSICAL ACTIVITY AND DOWN SYNDROME: AN OVERVIEW

Physically inactivity is one of the ten leading risk factors for global mortality. It was estimated that there are about 20-30% increased risk of all-caused mortality for people who are insufficiently physically active (WHO, 2018). According to Bradney et al. (1998); LeMura and Maziekas (2002) state that regular physical activity is essential for the development of a healthy musculoskeletal system and healthy body size.

Burns *et al.* (1993) state that general fitness level of children, adolescents, and adults with Down syndrome (DS) is lower than other people with Intellectual disability. In addition, Pitetti *et al.*(1992) believed down syndrome have impaired both of motivational and physiological basis . Roizen and Patterson (2003) state that Down syndrome have a shorter life expectancy than the general population and experience accelerated ageing and higher mortality due to neurodegeneration, cancer and immunological disorders and increased incidence of obesity .

As Haverkamp *et al.* (2017) mention that 77% of DS had reported BMIs that were in the overweight or obese range. Overweight and obesity was much higher in DS compared to general population this risk increased with age. It will affect the performance hence down syndrome have a tendency to become obese in childhood (Cronk, et al., 1985). Obesity is common in males and females with Down syndrome. They have a higher percentage of body fat, and a greater body mass index than age-matched peers (Pitetti KH and Boneh S, 1995). Low physical fitness will increase the risk overweight or obesity as Down syndrome have functional impact as well as decrease in bone mass development. Down syndrome may have poor physical state due to syndrome-specific conditions, such as heart problems that is because lack of expectation program. It leads to Down syndrome less to participate in physical activity.

2.2 PHYSICAL FITNESS AND DOWN SYNDROME

Physical fitness is a set of attributes that people have or achieved. Being physically fit has been defined as "the ability to carry out daily tasks with vigour and alertness, without undue fatigue and with ample energy to enjoy leisure-time pursuits and to meet unforeseen emergencies". Fitness is divided into health and skill related components. Health-related physical fitness is a measure of a person's general physical wellbeing. It is comprised of five different components: cardiorespiratory endurance, muscular strength, muscular endurance, flexibility, and body composition (Ayers & Sariscsany, 2011).

All these components are directly related to one's health and quality of life. Every individual needs a minimum level of each component in order to perform regular daily living activities. Ayers and Sariscsany (2011) stated that higher level of health-related fitness also reduces the risk for cardiovascular disease and other non-communicable diseases as well as promote physical, social, and emotional health.

2.2.1 CARDIORESPIRATORY ENDURANCE

Cardiorespiratory endurance is the ability to be active for a prolonged period of time at a moderate to high intensity level and is aerobic (needing oxygen) in nature (Cicomascolo & Sullivan, 2013). It is also referred to as cardiorespiratory endurance or aerobic capacity. Based on Horvat et al. (2002) total capacity performance is check by capacity for aerobic (VO_{2max}) and anaerobic performance. Low VO_{2max} is linked to morbidity, mortality and increased risk of several diseases such as coronary heart disease and high blood pressure. Conversely, higher level of cardiorespiratory endurance component, reduces risk of various health related diseases or non-communicable disease(NCD).

According to Fernhall *et al.*(2001) and Baynard *et al.*(2004), lower level of cardiovascular fitness in children and adolescents with down syndrome compared with peer without Down syndrome. The study conducted by Eberhard et al. (1989), 15% lower VO₂peak in DS using bicycle ergometry compared general population. There have another study that conducted by Fernhall *et al.* (1990) using a validated treadmill protocol, reported that lower VO₂peak DS.

2.2.2 MUSCLE ENDURANCE

Muscle endurance is the ability of a muscle or muscle group to perform repeated contractions against a resistance over a period of time. (Coulson & Archer, 2009). The muscular endurance of major muscle groups in the body can be assessed by push-up test, curl-up test and also squat endurance test. Good muscular strength and endurance can increase the level of performance, self-image, injury prevention and also body composition. In addition, enhanced in muscular strength and endurance can prevent injury by maintaining good body posture and promote proper body mechanics during daily routine such as walking and lifting (Cespedes, 2013).

As Hakkinen *et al.* (1985) mention that DS have poor muscular strength especially in the lower limbs. In the study by Cowley *et al.* (2010) knee extensor strength, as a critical factor of functional skills in people with Down's Syndrome, was found to be a good predictor of timed performance in tasks of daily living such as walking upstairs and downstairs and rising from a chair. According to Sukriti *et al.* (2011) mention that poor muscular strength is affected by muscle hypotonia and joint laxity for people with Down's Syndrome throughout their lifespan.

Based on a study that conducted by Pitetti & Yarmer (2002) reported that general populations were significantly stronger than DS in all isometric strength measurements. For DS decreasing leg and back strength is a serious health and social concern. Poor leg and back muscle strength has also been linked to a higher incidence of osteoporosis and greater risk of falling among individuals with DS (Pitetti & Yarmer ,2002)

2.2.3 MUSCLE STRENGTH

Muscular strength is the maximum amount of force a muscle or muscle group can generate (Coulson & Archer, 2009). This is commonly measured by performing a one repetition maximum for a specific exercise. It also can be estimated by performing an exercise with heavy resistance until failure, or by used of dynamometers. This health related fitness component is vital for all individuals, especially those with intellectual disabilities (Shields & Taylor, 2010). It can have a direct effect on a person's ability to perform regular daily activities and work-related tasks.

The studies conducted by Sharav and Bowman(1992) and Pitetti *et al.*(1992) about manual grip strength in Down syndrome subject. They concluded that strength of Down syndrome is lower than people without syndrome and there is strong association between muscle hypotonia and strength deficit.

Winders (2001) stated that Down Syndrome tend to lack in muscle strength comparatively to normal population. There are a few possible reasons why this occurs. However, there have not been any definitive findings. Berry and Andrews (1980) mention there is one possible explanation is that increases in muscle strength are largely a function of physical activity. It has been found that Down Syndrome engage in less physical activity than general population, and as a result, do not develop as much muscle mass. Berry and Andrews (1980) mention there have another related possible explanation is that Down Syndrome need to exercise more frequently, and for longer periods of time in order to reach the same levels of strength as general population.

2.2.4 BODY COMPOSITION

Body composition is a health-related fitness component that is used to describe the proportion of fat mass to fat-free mass in the body. Bone, muscle, connective tissue, blood, and organs make up the bulk of the fat-free mass (Health and wellness for life, 2010). There are several ways to measure body composition, but there are two common methods which are body mass index (BMI) and percent body fat. Body mass index (BMI) is a measure of a person's stockiness (body mass in kilograms divided by height in meters squared, $BMI = \text{Weight} / \text{Height}^2$) used to assess if a person is underweight, of healthy

weight, overweight, or obese (Swain, 2014). Body fat percentage (BF%) as a percentage of total bodyweight has advantages over BMI in estimating fat mass. (Meeuwsen et al. 2010). As Keskinen et al. (2004) mention that the increase in body fat increase risk for hyperlipidemia, hypertension and coronary heart disease.

The body size and composition is important for athletes to success in sport. The changes of muscle and fat distribution and proportion within body may due to an effective training. As Wood R (2010) state that body compositions such as amount of body fat and muscle mass can affect sport performances of athletes. It is very important in sport and in certain sports someone can be advantage for being lights (gymnastic), tall (basketball), heavy (sumo wrestling) and others. Effective nutritional strategies are important in order to achieve ideal body weight for optimal sport performance.

Rubin *et al.* (1998) and Baur *et al.*(2009)reported that prevalence of overweight and obesity are substantially higher in individuals with DS compared with ID but without down syndrome. Prasher (1995) reported that 48% of adults with DS were obese, with 27% being overweight both male and female. This is consistent with Rubin *et al.* (1998) report of 48% for men and 56% of women being overweight or obese. However, Mercer & Lewis,(2001) and Baptista *et al.* (2005) found that DS have shown a tendency toward a higher BMI and percentage of body fat in groups with DS compared with those without ID due to less active and more prone to spending more time indoors.

Rimmer *et al.* (2010) reported an obesity prevalence of 31% based on Centres for Disease Control and Prevention (CDC) criteria in a convenience sample of 81 youth with DS surveyed via the internet, providing some evidence that obesity is significantly higher in this population. As Sharav & Bowman (1992) mention that DS described as less active and more prone to spending more time indoors, but no differences were found in the BMI values between children with DS and their siblings without ID.

2.2.5 FLEXIBILITY

Flexibility is defined as the maximum range of motion of a joint (Swain, 2014). Improved flexibility may enhance sport performance especially in aerobic training and as well as muscular conditioning.

As Lotan (2007) mention that hyper mobility and joint laxity that is common in Down Syndrome, it is not a recommended activity for this population. According Karinharju (2005) stated that Down syndrome had higher scores in sit-and reach measurements than general population and however, objective information concerning flexibility in DS is lacking.

Sacks (2003) stated that children with Down Syndrome are more flexible than typically developing children due to not only muscle tone, but to ligamentous laxity. Winders(2001) mention that children with Down Syndrome have hyper flexible joints, because the ligaments that hold the bones together are looser than the ligaments in typically developing children . This is due to the difference in collagen found in the ligaments of children with Down Syndrome. Collagen is one of the main proteins that make up ligaments, tendons, and cartilage. One of the types of collagen (type IV) that is found in ligaments, is encoded by a gene found on the 21st chromosome. Sacks (2003) state that children with Down Syndrome have an additional 21st chromosome so there is an excess of type IV collagen produced in the ligaments and this was causes ligament malformation, resulting in increased laxity, or looseness, of the ligaments.

There have one study that carry out by Parker *et al.* (1985) which using goniometric technique to examination the changes in flexibility in Down syndrome and compare with norms control. They reported that the greatest reduce of flexibility in Down syndrome. It is postulated that this may be attributable to the reduction in generalized muscular hypotonia expected during this age period, or decline in the rate of maturation of joint structures caused by the effects of the syndrome on the intrinsic mechanisms regulating the growth of joints. This could lead to decrease in flexibly.

2.3 THE BENEFITS OF PARTICIPATION IN PHYSICAL ACTIVITY

Physical inactivity could lead to overweight and obesity, developing diabetes, high blood pressure, high level of cholesterol, asthma, arthritis and heart diseases (World Heart Federation, 2017).

According to the WHO (World Health Organisation, 2018), the number one killer is coronary heart disease while stroke is the second top killer in Malaysia in the year 2014. Vicente-Rodriguez et al. (2005) state that physical activity and sport participation promote health benefits in children and adolescents. It will improve cardiovascular fitness and become healthier lifestyle (Stewart et al., 2003).

Moderate levels of physical activity among children and with disabilities is important goal to be promoted as regular physical activity leads to the prevention of chronic disease and help to improves well-being (Rimmer et al. 1994) .Children with disabilities should be encouraged with physical activities because it can enhance overall well-being and may also improve physical functioning (Nancy,2008).

As the study conducted by Biddle *et al.*(2000) and Hunt (2003) showed that physical activity improved "psychological well-being" (the way in which we deal with stress and mental functioning, such as decision making, planning, and short-term memory), reduced anxiety, and promoted healthier sleep patterns. Mounting evidence negatively correlates between exercise, anxiety, stress, and depression.

Exercise can help to relieve stress, elevate physical and mental energy and through the release of endorphins. Several hormones such as dopamine, serotonin, norepinephrine are released during exercising that help to increase focus and attention level (Robinson & Segal, 2017).

General fitness level of Down syndrome (DS) is low (Jobling, 1994) due to sedentary life style (Pitetti, and Campbell, 1991), and low motivation for participation in physical activities (Halle *et al.* 1999). According to Cruz *et al.* (2007) reported physical inactivity is one of the main risk factors that lead to unhealthy health status and can also increase the initiation of cardiovascular diseases (CVD) such as heart attack and stroke.

Franklin *et al.* (2000) stated that regular physical activity enhance cardiovascular and respiratory muscle function, reduce risk of coronary artery disease (i.e., High Blood pressure, or abnormal serum lipid profiles) and a decreased level of loss of life and condition of being diseased. The benefits also may include improve feelings of well-being, work performance, recreation, and sports activities.

As Shields and Blee (2015) specified that Down syndrome are a special population in the context of their health-related physical fitness. Physical activity is essential to a child with Down syndrome's health, fitness and wellbeing. It supports the development of their bones, improves their movement and encourages balance and coordination skills. Additionally, physical activity promotes the development of social skills, encourages

children to be independent and helps them maintain a healthy body weight. Performing enough physical activity can improve sleep, concentration, academic performance and self-esteem. Regular physical activity has long-term health benefits, as it reduces the risk of cardiovascular disease, type 2 diabetes, osteoporosis, depression and obesity. These benefits are particularly important for people with Down syndrome, as they are at a higher risk of developing these conditions

Physical activity is very important in maintaining physical fitness level and the health condition among Down syndrome. The findings of this study may benefit for parents, and educators to create a healthy lifestyle among Down syndrome. Maybe the findings of this study also ought to be used by parents and educators to build special program and health physical activities for the Down syndrome.

This study aims to investigate physical fitness level among Down syndrome in Kelantan. Besides, this study in this research there are five tests that will be used to monitor the following indicators of physical fitness such as body composition, muscular strength and muscular endurance and cardiorespiratory endurance and flexibility. There is a significant lack of information in DS, it is evident that this population could benefit considerably from Physical Activity and exercise prescription. The current study investigated health related physical fitness level among Down syndrome in Kelantan.

CHAPTER 3: METHODOLOGY

3.1 GENERAL METHODOLOGY:

This study is aimed to investigate level of health related physical fitness among down syndrome (DS) in Kelantan. This study is a cross-sectional using a convenience sampling method. The physical fitness level of Down syndrome were observed based on several measured parameters such as anthropometric measurements for BMI and body fat percentage, sit-ups, push-ups, sit and reach test, hand grip and Rockport walking test .

3.2 PARTICIPANTS

Participants of this study are Down syndrome age between 13 – 39 years old. The researcher *obtained* consent from their parent/caretaker prior to participation in this study. All Down syndrome who are registered in the Community Based rehabilitation (CBR) in Kelantan were invited to participate in the study. To increase the participation rate, the members of the Kelantan Down Syndrome Association was also invited to participate in the study. Down Syndromes who met the inclusion and exclusion criteria were invited to participate in the study. The inclusion and exclusion criteria for this study are:

Inclusion criteria	Exclusion criteria
Down Syndrome age range 13 to 39	Down Syndrome that have acute and chronic health condition
Ability to understand and follow instructions	

3.2.1 SAMPLE SIZE CALCULATION

The sample size was calculated by using survey software. The confidence level was set at 80%. The estimated participants were recruited in this study was 15 participants. Since, the dropout rate was 10%. Therefore, 16 participants were recruited in this study.

3.3 PROCEDURE AND INSTRUMENT

The study was approved by the University Science of Malaysia ethical committee (USM/JEPeM/17120712) and permission to conduct the study from the Welfare Department. The administration of the Kubang Kerian CBR was also contacted for participant recruitment. To increase participations, the Kelantan Down Syndrome Association was also contacted. The participant's recruitment from the association was made via posters announcement and advertisement to the members of Kelantan Down syndrome Association. Potential participants who met the inclusion criteria were invited to participate in the study. The researcher made an appointment to meet the participants, their

care taker and family, either individually or in groups, to explain about the study. The care taker of all participants was given the research information set and was briefed about the study. The caretaker completed the Participant Information and Consent form to allow their Down Syndrome (DS) children to participate in the study. The consent form was kept by the researchers for verification purposes as well as stating that they agreed to participate voluntarily. All information were treated as a confidential document. In addition to the consent form, the participant (the caretaker) were also given a demographic data form which asked about their name, age, gender, height and weight.

The main objective of this study is to investigate physical fitness level of Down syndrome in Kelantan, thus the participants were measured for their anthropometric measurements and their physical fitness. The anthropometric measurements are including body mass index (BMI) and percent body fat.

3.3.1 BODY ANTHROPOMETRIC

Participant's body weight was measured using a weighing scale whereas the height was taken with SECA 206 body meter. Hence, the Body Mass Index (BMI) was taken by calculating the persons weight in kilograms (kg) divided by height square meters. Meanwhile, body fats percentage was recorded by an Omron fat analyzer.