

**EFFECTIVENESS OF A STRUCTURED  
VIRTUAL EXERCISE PROGRAMME AMONG  
INTELLECTUALLY DISABLED INDIVIDUALS  
IN KELANTAN**

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IN KELANTAN**

**by**

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## TABLE OF CONTENTS

<b>ACKNOWLEDGEMENT.....</b>	<b>ii</b>
<b>TABLE OF CONTENTS.....</b>	<b>iii</b>
<b>LIST OF TABLES.....</b>	<b>vii</b>
<b>LIST OF FIGURES.....</b>	<b>viii</b>
<b>LIST OF ABBREVIATIONS.....</b>	<b>ix</b>
<b>LIST OF APPENDICES.....</b>	<b>x</b>
<b>ABSTRAK.....</b>	<b>xi</b>
<b>ABSTRACT.....</b>	<b>v</b>
<b>CHAPTER 1 INTRODUCTION.....</b>	<b>1</b>
1.1 Background of Study.....	1
1.2 Problem Statement.....	5
1.3 Objectives of Study.....	6
1.3.1 General Objectives.....	6
1.3.2 Specific Objectives.....	6
1.4 Hypothesis of Study.....	7
1.5 Significance of Study.....	8
1.6 Conceptual Framework.....	8
<b>CHAPTER 2 LITERATURE REVIEW.....</b>	<b>9</b>
2.1 Impacts of Covid-19: Negative Effects on Physical Activity and Mental Health among Disabled People.....	9
2.2 Barriers to Participation in Physical Activity for Intellectual Disabled Individuals.....	10
2.3 Impacts of Covid-19: Negative Effects on Disabled People to Physical	

Activity and Mental Health.....	11
2.3.1 General Guidelines for Sport Participation in Disabled Population..	14
2.3.2 Training Programme Prescription for ID Individuals.....	16
2.3.3 Training Methods to Improve Strength, Power, and Endurance.....	18
2.4 Training Adaptation and Fitness Level Progression in Sedentary and Intellectually Disabled Individuals .....	20
2.4.1 Effect of Exercise and Body Composition Among Intellectually Disabled Individuals .....	21
2.4.2 Effect of Exercise on Flexibility Among Intellectually Disabled Individuals .....	24
2.4.3 Effect of Exercise on Muscular Strength and Power Among Disabled People.....	25
2.5 Specific Guidelines for Exercise Prescription Among Disabled People....	26
2.6 Conclusion.....	28
<b>CHAPTER 3 METHODOLOGY.....</b>	<b>30</b>
3.1 Study Design.....	30
3.2 Population and Sample.....	32
3.3 Sample Size Calculation.....	33
3.4 Participants Recruitment .....	33
3.5 Study Procedure.....	34
3.5.1 Preliminary Test.....	34
3.5.2 Pre-Test Session.....	35
3.6 Measurement.....	36
3.6.1 Anthropometry and Body Composition.....	36
3.6.2 Flexibility (Sit and Reach) .....	36

3.6.3	Muscular Strength and Power.....	37
3.6.3 (a)	Handgrip strength.....	37
3.6.3 (b)	Standing Long Jump.....	38
3.6.4	20- meter speed.....	39
3.6.5	Aerobic Endurance Test (800 m Run Walk Test) .....	40
3.6.6	Gait Speed Analysis Features.....	40
3.7	Exercise program.....	41
3.8	Statistical Analysis.....	45
3.9	Ethical Consideration.....	45
3.10	Subject Vulnerability.....	47
3.11	Privacy and Confidentially.....	47
3.12	Specimen/data Handling.....	47
3.13	Risk.....	47
3.14	Community Sensitivities and Benefits.....	48
<b>CHAPTER 4</b>	<b>RESULTS.....</b>	<b>49</b>
4.1	Anthropometry and Body Composition of Participants.....	49
4.2	Physical Related Fitness Level of The Participants.....	50
4.3	Anthropometry and Body Composition of The Participants Between Control and Exercise Groups.....	51
4.4	Physical Fitness in Pre- and Post-test for Control and Exercise Groups...	53
4.4.1	Sit and Reach.....	53
4.4.2	Hand Grip Strength.....	53
4.4.3	Standing Long Jump.....	53
4.4.4	20-Meter Speed.....	54
4.4.5	800-Meter Run Walk Test.....	54

4.5	Gait Features Analysis in Pre- and Post-test for Control and Exercise	
	Groups.....	55
4.5.1	Speed.....	55
4.5.2	Stride Length.....	56
4.5.3	Acceleration.....	56
4.6	Results Summary.....	57
<b>CHAPTER 5 DISCUSSION.....</b>		<b>58</b>
5.1	Research Discussion.....	58
5.2	Anthropometry and Body Composition.....	59
5.3	Flexibility.....	60
5.4	Muscular Strength and Power.....	61
5.5	20 Meter Speed and 800 Meter Endurance Test.....	62
5.6	Strength and Limitation of Study.....	63
<b>CHAPTER 6 CONCLUSION AND RECOMMENDATIONS.....</b>		<b>67</b>
6.1	Conclusion.....	67
6.2	Suggestion for Future Study.....	68
<b>REFERENCES.....</b>		<b>70</b>
<b>APPENDICES</b>		

## LIST OF TABLES

	Page
Table 3.1      Type of activities included in the 8 weeks <b><u>of virtual structured exercise programme</u></b> .....	43
Table 4.1      Anthropometry and body compositions among intellectually disabled people at the baseline level.....	50
Table 4.2      The mean of selected physical fitness among intellectually disabled participants.....	51
Table 4.3      Comparison of anthropometry and body composition between exercise and control groups among intellectually disabled participants.....	52
Table 4.4      Comparison of sit and reach, hand grip, standing long jump, 20-meter speed and 800- meter ran walk tests between exercise and control groups among intellectually disabled participants.....	55
Table 4.5      Comparison of gait features of speed, stride length and time between exercise and control groups among intellectually disabled participants.....	56



## LIST OF FIGURES

	<b>Page</b>
Figure 1.1      Conceptual Framework.....	8
Figure 3.1      Sit and reach measurement.....	37
Figure 3.2      Handgrip measurement.....	38
Figure 3.3      Standing long jump measurement.....	39
Figure 3.4      Test configuration for the 20-m sprint test.....	39
Figure 3.5      Aerobic endurance test (800-m run walk test) .....	40
Figure 3.6      Gait speed analysis features.....	41
Figure 3.7      Flow chart of experimental design.....	44
Figure 3.8      Consort diagram.....	46

## **LIST OF ABBREVIATIONS**

ID	Intellectually disabled
WHO	World Health Organization
ACSM	American College of Sports Medicine
BMI	Body mass index
sEMG	Surface electromyography
Pusat PDK	Pusat Pemulihan Dalam Komuniti
OKU	Orang Kelainan Upaya
PA	Physical activity
HRR	Heart Rate Reserve
FFM	Fat Free Mass
FP	Fat Percentage
SD	Standard Deviation

## **LIST OF APPENDICES**

Appendix A	Ethical approval letter
Appendix B	Consent form
Appendix C	Data collection session
Appendix D	OKU Aktif Ebook cover
Appendix F	Paper Presented
Appendix G	Research University Grant

**KEBERKESANAN PROGRAM SENAMAN BERSTRUKTUR SECARA  
MAYA DALAM KALANGAN INDIVIDU KURANG UPAYA INTELEK DI  
KELANTAN**

**ABSTRAK**

Individu kelainan upaya intelek mempunyai masalah dari segi fungsi intelek dan pelarasan tingkah laku namun ia bergantung kepada tahap masalah mereka. Tambahan pula, golongan ini lebih cenderung kepada masalah obesiti, tidak aktif secara fizikal serta tiga kali lebih berisiko terhadap penyakit kronik. Keutamaan untuk mengamalkan gaya hidup sihat melalui senaman merupakan kaedah yang terbaik untuk meningkatkan kesihatan. Kajian ini mengkaji kesan 8 minggu senaman berstruktur secara maya dalam kalangan orang kelainan upaya intelek di Kelantan. Seramai 30 orang peserta yang berusia  $22.6 \pm 2.8$  tahun dan telah dibahagikan kepada dua kumpulan iaitu kumpulan latihan dan kumpulan kawalan. Peserta kajian melibatkan 16 pusat pemulihan dalam komuniti (PDK) sekitar negeri Kelantan. Peserta dalam kumpulan latihan telah terlibat dalam senaman kekuatan dan daya tahan secara maya selama 30 minit, 3 kali seminggu untuk 8 minggu. Manakala, kumpulan kawalan menjalani rutin harian seperti biasa dan tidak terlibat secara langsung dalam intervensi latihan ini. Secara asasnya, kesemua peserta kajian mempunyai berat badan yang ideal, dan purata jisim indeks badan yang normal,  $21.2 \pm 0.07 \text{ kg/m}^2$ . Keseluruhannya, nilai purata ujian duduk dan jangkau adalah  $4.6 \pm 8.8$  cm dan dikategorikan sederhana. Kekuatan genggam tangan peserta pula menunjukkan  $27.8 \pm 9.7$  kg iaitu lemah. Manakala, jarak lompat jauh berdiri pula ialah  $140.8 \pm 50.2$  cm, ujian kelajuan 20 m ialah  $4.5 \pm 1.6$  s dan ujian 800 m jalan

kaki-lari ialah  $6.2 \pm 1.6$  minit yang mana dianggap sebagai sederhana. Selepas intervensi selama 8 minggu, kumpulan latihan menunjukkan peningkatan yang signifikan bagi jisim tanpa lemak (FFM) (meningkat 21.3%), peratusan lemak (berkurangan 11.7%) dan indeks jisim badan (BMI) (berkurangan 0.9%) walaupun tiada perubahan dalam berat badan. Walaubagaimanapun, kumpulan kawalan juga menunjukkan peningkatan yang positif yang kecil keatas parameter komposisi badan kecuali BMI (meningkat 2%). Bagi ujian komponen kecergasan terpilih, kumpulan latihan meningkat secara signifikan bagi duduk dan jangkau ( $p = 0.018$ , 33.2% lebih fleksibiliti) dan ujian 800 m jalan kaki-lari ( $p = 0.007$ , 11% lebih pantas). Kumpulan kawalan pula menunjukkan penurunan yang signifikan bagi kekuatan genggam tangan ( $p = 0.024$ ), ujian kelajuan 20 m dilakukan dengan baik ( $p = 0.017$ , 8.5% lebih pantas) pada ujian pasca dan lebih baik berbanding kumpulan latihan. Berdasarkan analisis menggunakan perisian Kinovea, tiada perbezaan yang signifikan bagi kelajuan, halaju dan panjang langkah antara kumpulan latihan dan kawalan. Walaubagaimanapun, panjang langkah bagi kumpulan melebar sebanyak 5.9% pada ujian pra berbanding kumpulan kawalan yang menurun sebanyak 1.9% semasa ujian kelajuan 20 m. Latihan kekuatan dan daya tahan secara maya selama 8 minggu bermanfaat kepada individu yang mempunyai kelainan upaya intelek terutama terhadap komposisi badan, ujian kecergasan seperti latihan duduk dan jangkau dan daya tahan serta panjang langkah larian. Tempoh masa yang panjang diperlukan bagi peningkatan yang signifikan pada masa depan bagi komponen kecergasan terpilih.

**EFFECTIVENESS OF A STRUCTURED VIRTUAL EXERCISE  
PROGRAMME AMONG INTELLECTUALLY DISABLED INDIVIDUALS  
IN KELANTAN**

**ABSTRACT**

Intellectually disabled (ID) have problems in terms of intellectual function and behaviour adjustment, however it depends on their severity. In fact, person with ID is more likely to be obese, physically inactive, and twice as likely high risk to suffer from some chronic diseases. In order to improve general health, it is best to prioritize a healthy lifestyle and to break bad habits through exercise. The present study aimed to determine the effect of 8-weeks structured virtual exercise program on selected fitness components among people with ID in Kelantan. Thirty participants aged  $22.6 \pm 2.8$  years old were randomly assigned into two groups, i.e., exercise and control groups. The participants were recruited from 16 rehabilitation centre in the community (PDK) in Kelantan. Participants in the exercise group was involved virtual strength and cardio exercise for 30 minutes, 3 times per week in 8-weeks. Meanwhile, control group had continued with their daily routines and did not involve directly with any exercise. At baseline, the participants were categorized to have an ideal body weight, as BMI was in normal range,  $21.2 \pm 0.07 \text{ kg/m}^2$ . Overall, the mean of sit and reach values among the participants were  $4.6 \pm 8.8\text{cm}$  which was categorized as average. Participant's handgrip was  $27.8 \pm 9.7\text{kg}$  which was known as weak. Meanwhile, their standing long jump distance was  $140.8 \pm 50.2\text{cm}$ , 20-meter speed was  $4.5 \pm 1.6\text{s}$  and 800meter run walk test was  $6.2 \pm 1.6\text{min}$  which were considered as average. After 8 weeks of

intervention, the exercise group demonstrated significant improvements in fat free mass (FFM) (increased 21.3%), fat percentage (reduced 11.7%) and body mass index (BMI) (reduced 0.9%) despite no changes in body weight. Moreover, the control group showed small positive changes on all body composition parameters except for BMI (increased 2%). As for selected fitness component tests, exercise groups improved significantly on sit and reach ( $p = 0.018$ , 33.2% better flexibility) and 800m run and walk ( $p = 0.007$ , 11% faster time). While participants in the control group showed significant reductions in hand grip strength ( $p = 0.024$ ), they performed very well in 20-meter speed tests ( $p = 0.017$ , 8.5 % faster in time) at post-test, which were better than the exercise groups. According to further analysis using Kinovea software, there were no significant differences in the speed, velocity and stride length between exercise and control groups. Nevertheless, the stride length of the exercise group widened by 5.9% at post-test compared to the stride length of the control group, which reduced by 1.9% during a 20-meter speed test. As a result, strength and cardio virtual exercise for 8 weeks can be beneficial to individuals with ID on body composition, the majorities of fitness components, particularly in terms of sit and reach and endurance activities and stride length during running. Future studies will require longer durations for further significant improvements on overall selected fitness components.

## CHAPTER 1

### INTRODUCTION

#### 1.1 Background of Study

According to the World Health Organization (WHO), individuals with disabilities are those who at one time, were prevented by physical or mental condition from performing normal peeractivities such as social, recreational, educational and vocational. Intellectual disability (ID) is also referred to mental disabilities or learning disabilities. It is also associated with the type of disabilities that involve thinking ability. People with ID have problems in terms of intellectual function and behaviour adjustment, and it depends on their severity. Scores for the level of intellectual development are determined based on available information, including clinical signs, adaptive behaviour in individual cultural mediums and psychometric findings (Children & Families, 2015). They may not be able to perform daily activities that involve practical and social skills. These conditions are normally detected before the age of 18 years old. The Diagnostic and Statistical Manual of Mental Disorders (DSM-5) published by the United States Psychiatric Association defines ID as a developmental problem that begins in childhood and is characterised by significant deficits in both intellectual and adaptive behaviour, including skills conceptual social and practical (Papazoglou et al., 2014).

People with mild ID are more likely to be obese, physically inactive, and twice as likely to suffer from some chronic diseases, such as diabetes and respiratory problems (Petteson et al, 2008, Barwick et al., 2011). In addition, Emerson (2006) also states that people with ID mostly are obese compared to the normal individual. The way to improve health in people with ID is to prioritise the involvement in exercise similar to normal individuals. Exercise is able to build up their fitness level



(Miller, 1995), improve the ability to maintain a higher level of independence (Moore et al., 2016), ease anxiety and depression (Otto, 2011), and subsequently enhance mood (Otto, 2011).

A systematic approach to physical training methods is essential to improve the components and performance of physical fitness in ID individuals. It is important to conduct a structured training at an early stage to achieve the maturity of sports performance (Pearson et al., 2006). Physical training should focus on cardiovascular fitness and muscular endurance improvement to enhance fitness and wellbeing. To monitor the progression in training, field assessments, and laboratory assessments can be conducted with a systematic analysis for each fitness components.

To date, the participation of people with disabilities either children or adults has increased. The availability of sports facilities, that are disabled friendly eases their effort to move and utilise the equipment. The participation of these community was very small due to lack of social support and lack of self-esteem. At the same time, involving in physical activities provides more benefits physically, mentally and physiologically. Previous study reported that people with disabilities have higher risk to diseases such as heart attack, obesity and hypertension compared to normal people. Thus, social support and improving the facilities can motivate the community to become active in physical activities either recreational or high-performance sports. Smith and Hanni (2017) mentioned that there were many benefits of physical activities that effects on physical and physiological such as preventing disease, improve self-esteem and growing social support relationships.

Barak et al. (2014) and Jaarsma et al. (2014) revealed that the promotion of adapted PA has been investigated among people living with disabilities. From the study, there are many factors and principles of training needed to be emphasized

before train the community due to lack of experiences and safety protocols. WHO (1980) and Glass (1998) defined disability as limitation of ability to perform of an activity in daily life activities. Bittles et al. (2002) reported that intellectually disabled individuals have a shorter lifespan and a higher mortality compared to normal population. People with disabilities should start the exercise at low intensity, for example walking exercise that can be done on an assistive device such as wheelchair. The exercise activity must be designed to ease them with movement to ensure that disabled people feel comfortable and adapt physically and physiologically. ACSM recommended the disabled people to perform 150 minutes of aerobic activity per week. However, a closed monitoring when performing a high intensity is needed to avoid injuries and other medical implications especially when they start to be physically active. Due to covid-19 pandemic, this present study will be conducted online to make sure that all the participants could join this exercise program in safe condition. The virtual exercise programme involves the use of technology to combine workouts and virtual reality. On the other words, participants can still do an exercise with the instructor from their own home.

Regarding exercise prescription, people with disabilities may need to do a strength training to develop muscular endurance and power. Previous studies shows that the strength training benefits health in decreasing abdominal fat, reduce risk of injury and develop flexibility also mobility (Shaw et al., 2015). National Strength and Conditioning Association (2009) stated that resistance training is a specialized method of physical conditioning that involves the progressive use of a widerange of resistive loads and a variety of training modalities that can involve equipment and non-equipment. Several examples of strength training exercises are body weight squat, dumbbell biceps curl, bench press and pull. Pearson et al., (2000) and Winnet

and Carpinelli (2001) stated that progressive overload was an essential element of an effective resistance training to develop muscle size, strength, and power. However, a proper techniques and guidelines from coaches and practitioners are important to avoid pain and injuries during training session.

Muscular strength can be defined as the ability to exert the force possible on an external object or resistance (Suchomel et al., 2016). Muscular power is the ability to generate a lot of force rapidly in one minute. Although strength (force output) and power (work/time) are quantitatively related, they remain separate physical parameter that can be measured in all dynamic muscular contractions, whether fast or slow. Example of exercise that can develop muscle are squat, push up, sit up, and resistance band exercise showed beneficial effects to ID people (Jacinto et al., 2021).

Gait analysis, it is the evaluation of the manner or style of walking usually done by observing the participant as they walk in a straight line (Vairis et al., 2021). Gait analysis gives information about the lower limb dysfunction including abnormal loading in dynamic movement using walking or running. People with ID have limitation in cognitive functioning and skills that affect their development and learning process to be slower than normal individuals, thus affect their characteristic of gait (Kuo et al., 2007). Mobility limitation are particular interest in people with ID (Salb et al., 2015). From a previous study, it shows that a patient with malfunctioning hip abductor will present with a positive Trendelenburg sign: which causes their pelvis to drop towards the side of the raised limb. The positive sign signifies that the abductor muscles on the standing limb become weak or paralyses. During walking, the negative impact in the abductor muscle gives rise to a characteristic of gait.

To date, there is still a small number of research that conduct exercise training to determine various fitness parameters in ID people in Malaysia. Thus, the present study will identify the effects of 8 weeks **of structured virtual exercise programme** on selected fitness components in individuals with ID.

## **1.2 Problem Statement**

The ID populations are mostly practicing a sedentary lifestyle which is the main contribution to obesity. Earlier study by Petteson et al, (2008) and Barwick et al, (2011) mentioned that intellectually disabled individuals are more likely to be obese due to physically inactive and could lead to high risk of chronic diseases, such as diabetes and respiratory problems. There is no published data or program, or lack of study that had been conducted on general fitness and performance among ID population in Malaysia. There is a lack of understanding on general fitness and performance and participation in physical activity among ID people in Malaysia. The present study sought to address the gap in the literature by investigating fitness components that can be measured during exercises and exploring the importance of fitness measurement for training progress. Additionally, lack of studied regarding the anthropometric characteristics of the ID people also should be addressed in order to gain more knowledge about ID populations. Therefore, conducting selected fitness components tests together with scientific analysis can provide guidelines to examine the fitness improvement among ID people.

The literature also suggests that the participation of disabled people in physical activities need to be supported by social supports, facilities and accessibilities which needs the cooperation of public and private sectors. The elimination of the barriers would have effects on the participation so that these

community were able to participate regularly in any physical program. Hence, the findings of this study will benefit a lot of people including family, community, coaches and practitioners.

### **1.3 Objectives of Study**

#### **1.3.1 General Objective**

The main objective of the present study is to examine the effectiveness of 8 weeks of structured virtual exercise programme on selected fitness components among intellectually disabled individuals in Kelantan.

#### **1.3.2 Specific Objectives:**

- 1) To determine the changes in anthropometry and body composition (body weight, free fat mass, fat percentage and BMI) between control and exercise groups among individual with ID after 8 weeks of structured virtual exercise programme.
- 2) To determine the changes in body flexibility (sit and reach) between control and exercise groups among individual with ID after 8 weeks of structured virtual exercise programme.
- 3) To determine the changes in muscular strength and power (hand grip and standing long jump) between control and exercise groups among individual with ID after 8 weeks of structured virtual exercise programme.
- 4) To determine the changes in 20-meter speed between the control and exercise groups among individual with ID after 8 weeks of structured virtual exercise programme.

- 5) To determine the changes in aerobic endurance test (800-meter run walk test) between the control and exercise groups among individual with ID after 8 weeks of structured virtual exercise programme.
- 6) To determine the changes in gait analysis features (speed, stride length and velocity) between the control and exercise groups among individual with ID after 8 weeks of structured virtual exercise programme.

#### **1.4 Hypotheses of Study**

HA<sub>1</sub>: There are significant changes in anthropometry and body composition (body weight, fatfree mass, fat percentage and BMI) between control and exercise groups among individual with ID after 8 weeks of structured virtual exercise programme.

HA<sub>2</sub>: There are significant changes in body flexibility (sit and reach) between control and exercise groups among individual with ID after 8 weeks of structured virtual exercise programme.

HA<sub>3</sub>: There are significant changes in muscular strength and power (hand grip and standing long jump) between control and exercise groups among individual with ID after 8 weeks of structured virtual exercise programme.

HA<sub>4</sub>: There are significant changes in 20-meter speed between control and exercise groups among individual with ID after 8 weeks of structured virtual exercise programme.

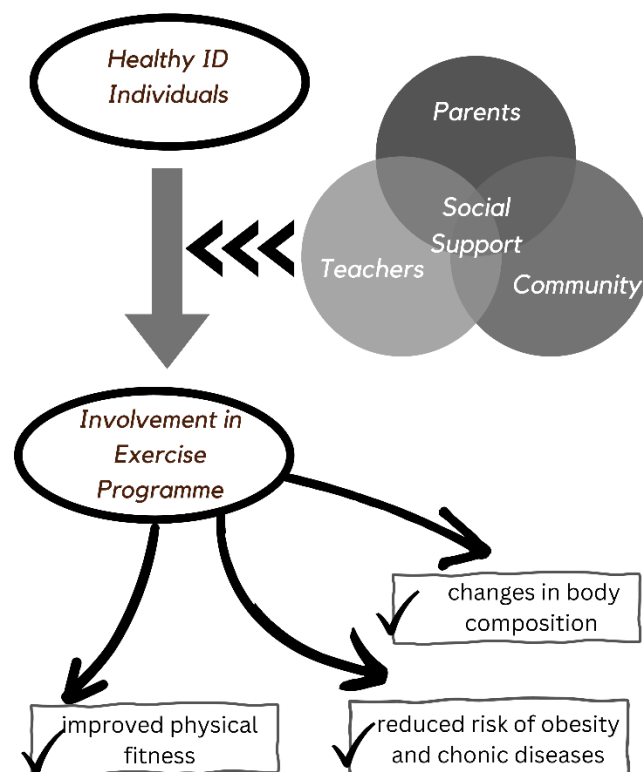
HA<sub>5</sub>: There are significant changes in aerobic endurance test (800-meter run walk test) between control and exercise groups among individual with ID after 8 weeks of structured virtual exercise programme.

HA<sub>6</sub>: There are significant changes in gait analysis features (speed, stride length and velocity) between control and exercise groups among individual with ID after 8 weeks of structured virtual exercise programme.

## 1.5 Significance of Study

Participating in a structured exercise would help people with ID to improve their fitness level and quality of life. Besides that, it is hoped that this study will improve their knowledge and educate people about the importance of being active and expose them to alternative exercises that are enjoyable and can be done at anytime and anywhere. Sports practitioners need to introduce a systematic approach by applying sports science knowledge to produce individuals with high level performance quality despite their disabilities.

## 1.6 Conceptual framework



**Figure 1.1** Conceptual framework

## **CHAPTER 2**

### **LITERATURE REVIEW**

#### **2.1 Vulnerability of ID Towards Obesity and Sedentary Lifestyle**

Intellectually disabled (ID) individuals are facing obesity problem and high risk of chronic diseases. Obesity is a serious health problem that reduce life expectancy and threatens the quality of life of individuals with disability and threatens their health (Yaprak et al., 2010). Although the cause of obesity among disabled individuals is unclear, changes in body composition due to inactivity and muscle atrophy as well as physiological changes are implicated (Liou et al., 2005). This is because they are at an increased risk of malnutrition due to food-drug interaction, metabolic dysfunction, and other developmental dysfunctions. These individuals also tend to exhibit unhealthy eating habits such as fussy eating, preference for high-calorie food, binge eating, and obsessing over food, all of which predispose them to increased body weight due to excess fat accumulation (Son et al., 2016).

Pandemic Covid-19 effects all of sectors including fitness and exercise due to highly risk of the virus. At the same time, movement control order (MCO) and lock down in Malaysia caused all of Malaysians to stay at home and practising social distancing. Hence, the pandemic has caused the decrease in physical active and cause fitness level among some people with ID to drop. However, there were many alternatives to maintain the fitnesslevel such as guiding the activities via online, home workout exercises; treadmill running, body weight workout and yoga exercises. There is no denying that the pandemic caused various negatives impacts on individuals' health. Nevertheless, a lot of previous research stated that physical activity or exercise were benefited mentally and physically such as reduce the risk of disease, strengthen



bones and muscles and improve the ability of daily routines. Therefore, the present study may benefit the coaches, exercise practitioners and family members to improve the performance and general health their people who having intellectual disability (ID) conditions.

## **2.2 Barriers to Participation in Physical Activity for Intellectual Disabled Individuals**

Previous study reported that people with disabilities seems to be highly risk to obesity, diabetes and other serious diseases. According to Junker and Carlberg (2011) and Schnohr et al. (2006), there are 11 million of people living with disabilities in United Kingdom were exposed to secondary diseases like obesity, diabetes and coronary heart disease due to lack of physical activities. At the same time, nutritional or food intake of participants are essential aspects to be monitored during intervention.

There are a few barriers which limit participation in physical activity for ID individuals. The ID individuals may be excluded or prevented from participating in physical activity due to cognitive, social, and motor skill deficits. They may feel discouraged from participating in any community recreational programs. Additional barriers to participation in physical activity for ID individuals may include lack of interest, lack of awareness, environmental constraint or physical and motor challenges (Bassette et al., 2020). Furthermore, ID individuals may prefer sedentary activities such as watching TV, playing video games or listening to music (Block et al., 20213). These barriers may also contribute to a lack of research regarding physical activity and ID individuals. Reason for these gaps is indicative of perceived concerns related to a lack of independence such as a reported difficulty of identifying strategies to assist ID

individuals to engage in physical activity and the perception that people with disabilities may not be able to participate in physical activity (Hilgenkamp et al., 20212). It is critical to identify appropriate strategies that promote independent performance of physical activity skills (Bassette et al., 2020). In the other words, the ability to perform exercise independently must be considered given the high level of prompt dependency frequency observed in people with disabilities during initial acquisition of various types of skills (Lovaas, 2003).

### **2.3 Impacts of Covid-19: Negative Effects on Physical Activity and Mental Health among Disabled People**

The Covid-19 pandemic had significant impacts on various aspects such as economies, human development, and health. Most countries all over the world were affected due to the virus of Covid-19. Therefore, most countries have taken various alternative to stop the spread of the virus Covid-19 such as movement control order (MCO), closed the border, wearing face mask and social distancing. According to the health authorities at the international level was alerted towards the type of the virus that was identified in the Chinese city of Wuhan at the end of December 2019 as it rapidly spread to the several cities. As the virus rapidly spread, the movement control order (MCO) was implemented which effected on the daily life routine such as physical activity, work from home and social activity (Giovanetti et al., 2020); Watkins, 2020).

However, Maugeri et al., (2020) stated that the exercise or training using the online platform was one of the optional methods for greater safety due to the social distancing order. As studied by Delbressine et al. (2021) and Osofsky,

(2020), the level of physical activity was significantly decreased and worsen the psychological well-being.

In addition, it is also reported that the decrease of physical activity due to lockdown policies caused negative effects such as obesity, muscle atrophy, bone loss, lack of aerobic capacity and cardiovascular vulnerability. It is found that the virus of Covid-19 negatively affects many aspects due to lockdown policies. However, there were variety of alternatives of home workout videos on internet to keep the individual stay active and healthy. Burhaein et al., (2021) analysed that physical activity should be maintained and increase at least 30 minutes a day and consume nutritious foods such as vitamins, fruits, and vegetables to prevent the spread of the virus Covid-19.

Mental health was a crucial element to ensure that stress and other mental problems can be avoided. As stated by Stults- Kolehmainen and Sinha (2014), stress has been contributing to health conditions such as cardiovascular disease. Overall, the pandemic of Covid-19 showed more negative effects on many aspects especially physical activity. Many policies such as lockdown and movement control order (MCO) reduce the spread of the virus. At the same time, there were many optional and methods on internet to maintain the physical performance. It is important to ensure that it beneficial physically and mentally.

Nowadays, people with disabilities participate more in physical activity and high- performance sports. The participation of people with disabilities in physical activity and sports influenced by social support, gain experience and motivation. The similar tournaments as normal community were held that involved people with disabilities such as Paralympics Games. As mentioned by Barak et al. (2014) and Jaarsma et al. (2014), the promotion of adapted physical activity was investigated

among the people with disabilities. Participation of these people with disabilities in physical activity and sports benefits them in terms of reducing the risk of disease and increasing mental wellness. At the same time, it also increases the interpersonal relations among normal community and people with disabilities. This is supported by Wilhite & Shank, (2009) and Pereira et al. (2013) that the enhancement of functional capacity, development of relationships and increasing self-esteem have been manifested by the benefits of physical activity.

Previously, lack of facilities and accessibility for people with disabilities was one of the factors that contribute to the lack of participation of this community in physical activity and sports. Wee et al., (2021) suggested that public sector, private sector and disabled person organization must cooperate to build a healthy environment and society for people with disabilities. Therefore, social and moral supports were needed to enhance their participation in physical activity and sports. World Health Organization (2011) reported people with disabilities were poorer health compared to the general community. Hence, participation of these disabled people in physical activity developed a healthy community in terms of wellbeing physically and mentally.

According to the World Health Organization (2015), people with disability was defined as who have long term physical, mental, intellectual, and sensory impairments in interaction with various barriers. The policies in the countries encourage and motivate people with disabilities to get involved in physical activity and sports to bridge the gap between the disability community and normal population. For example, *The Person with Disabilities Act 2008 of Malaysia (Law of Malaysia, Act 685)* was introduced by the Malaysian Government. The act enabled access for people with disabilities in recreational, leisure and sports. The

support from public and private sector will enhance the participation of this community in physical activity and encourage them to be independent in public areas.

In short, the participation of people with disabilities in physical activity and sports will benefit this community to reduce the risk of disease and promote wellness. Hence, social support for both community, public and private sector was important. At the same time, the facilities and accessibility for this community must be expanded in many areas to develop healthy disabilities community and can compete at national or international levels in sports.

### **2.3.1 General Guidelines for Sport Participation in Disabled Population**

The series paper provides a global overview on the benefits and promotion policies towards physical activity among people with disabilities based on meta-analysis. Statistically, 16-62% of people living with disabilities (PLWD) were at higher risk of serious health problems related to inactivity than people without disabilities (Ginis et al., 2021). The health benefits can be achieved with 150 minutes of physical activity in a week. Additionally, physical activity has been shown to have benefits on cardiovascular fitness.

The participation of this community in physical activities and sports were highly recommended to increase health level and provide social networking. However, there was a list of guidelines for this community due to the difference in level of physical appearance and mental condition. People with disabilities may start slowly based on their fitness level and abilities. Progression monitoring was needed to avoid lack of motivation to achieve the goals in sports or physical activities.

Aerobic physical activity can be modified to suit ID condition. Aerobic physical activity provides benefits such as reducing the risk of heart attack, obesity, and diabetes. Other physical activities include brisk walking, aquatic therapy, seated volleyball and wheelchair basketball or tennis can be introduced too.

Current study by Wee et al. (2021) revealed that the participation of people with disabilities were motivated by satisfaction, socialization, achieving fitness and enjoyment. However, most people with disabilities were not participated due to lack of social support, lack of facilities and accessibility. Researchers suggested that public sector, private sector and disable person organization must cooperate to build a healthy environment and society for people with disabilities.

Study by Aydogan & Hadi (2020) involved twelve of physical disabilities adults; 5 women and 7 men. The criterion of sampling method to determine the participants were, (i) participating in sports, (ii) having an acquired physical (orthopaedic) disability, (iii) over the age of 18 and (iv) having national or international achievement in sports. A semi-structured interview technique was used then content analysis was used to analyse the data. The findings of the study reported that the factors of resilience of disabilities individuals were social support, spiritual and belief and positive outlooks. This study concluded that participating in sports provides the strength in people to gain experience and establish interpersonal relations.

### **2.3.2 Training Programme Prescription for ID Individuals**

A well-planned training programs could help individuals to achieve optimal performance during competitions. Therefore, the prescriptions of the training program designed by professionals are important to improve the fitness and performance of an athlete. To date, there is a lack of research that has been done focusing on the training programme prescription among individuals with disabilities. Only one research by Mazzeo (2001) which focuses on exercise prescription for the elderly. Proper instruction on correct technique and safety at the beginning of the training could be necessary to reduce the risk of injury as well as other health-related complications, this instruction also can be received from professionally trained and certified trainers.

According to the coaching association of Canada (2005), there are recommendations for coaching individuals with intellectual impairments. These includes a proper planning on drills or activities that are age appropriate, teaching the prerequisite skills for example basic motor skills, do not overload participants with instructions, check regularly for understanding (may take longer to process information or instructions) and teach the specific skills. Intellectually disabled individuals may have difficulty transferring skills from one environment to another. Provide repetition, structure, and routine to support their memory. Aside from health-related components of physical fitness, an individual also requires well developed skill-related physical fitness components, such as coordination, balance, speed, agility, reaction time and power so that they be able to perform activities of daily living.

It is a common finding in the literature that individuals with ID have poor balance control (Enkelaar et al., 2012). Compared to peers without ID, individuals

with ID demonstrate greater instability during both quiet standing and walking. Their balance impairments should be attributed to extrinsic factors such as their lower level of physical activity, and intrinsic factors like inadequate development of the central nervous system. Commonly, individuals with intellectual disability have physical ability to perform running, throwing, and jumping motion using the correct technique. Resistance exercise programs for ID individuals are important because they have a positive impact on quality of life (Draheim et al., 2002; Frey et al., 1999). However, coaches are needed to give extra attention to the principle of motor learning, when introducing a new skill because ID individuals tend to forget whatever skill they have learned before (Messent et al., 1999). A coach should use simple one-part or two-part directions, to introduce new skills gradually and review their progress frequently. For instance, in athletic events, coaches need sometimes to explain the technique to use their right and left leg during exercise. Demonstrations of the right technique are extremely important in explaining every skill. Since ID individuals cannot read or write properly, or even differentiate between each limb well, a coach needs to explain repeatedly how to execute every skill. Other than that, incidence of obesity among individuals with mental retardation is high and keep increasing in adulthood. Thus, it is necessary to emphasize the percentage of body fat among the participants to improve running performance. Lower body fat percentage would contribute positive effects in 100m and 300m track and field events (Guidetti et al., 2010).



### **2.3.3 Training Methods to Improve Strength, Power and Endurance**

The body weight training was an alternative training to traditional strength training. Traditional strength training focuses on building strength while not really affecting other system. It works on one muscle group at a time to exhaustion using heavy weight or gym machines. Traditional strength training encompasses the prescription of conventional gym-based training exercise such as bench press, latissimus pull-down, pull ups, squats and triceps extensions. Meanwhile the other type of exercise is by using body weight as a resistance to increase performance depends on the training program. This body weight training can generate muscular power, strength, and endurance. Physical fitness was essential to ensure health and wellness among people. For example, push up exercise strengthens the upper body muscle meanwhile squat jump generates lower body muscular power. Maintaining physical fitness either strength, power or endurance helps to increase performance and reduce the risk of injury due to the adaptation. McManis et al., (2000) mentioned that the essential components of physical fitness were muscular strength and endurance. Hence, body weight training gained more benefits and effective to increase performance.

However, a proper technique must be applied in body weight training to avoid the risk of injury. As stated by Lipecki and Rutowicz (2015), body weight training was effective to increase general physical fitness. At the same time, researchers also mentioned that body weight training showed a small impact on performance without nutritional control and balanced diet. Previous research found that body weight training burns lot of calories by having high intensity training. At the same time, this contributed to the increasing of metabolism rate. Bombelli et al.

(2013) stated the abnormal of morphological fitness of body structure and composition lead to a higher risk of death and disease.

Overall, there are benefits of body weight training to health and performance. Previous research mentioned that body weight training was effective to enhance physical fitness and avoid the risk of injury.

For instance, study by Vossen et al. (2000), thirty-five of healthy women were recruited in the study and underwent 18 training session for 6 weeks. They were divided into two groups in either dynamic push up ( $n = 17$ ) and plyometric push up ( $n = 18$ ) groups. It was found that plyometric push up group was significantly greater compared to dynamic push up on medicine ball throw. However, there were no significant differences found between groups on chest press. Nevertheless, plyometric push up performed better.

Another study by Arifin et al. (2020), revealed that push up test showed varied results from intercorrelation class (ICC) analysis compared to sit up, and pull up in one minute because it involved specific muscle on arm more than pull up and sit up. In this study, thirteen experienced males were involved and performed four repetitions for each dip variation. 3D motion capture, surface electromyography (sEMG) and muscle activation pattern to determine and compare the kinematics. Each of the variation (bench dip, bar grip and ring dips) was analysed using one way ANOVA with repeated measure. There was significant difference was observed between dip variation on kinematics profile and sEMG. A higher peak muscle was activated in the bar grip compared to bench grip. The findings mentioned that a proper prescription of training was needed especially for those who have a history of injury and shoulder pain (McKenzie et al., 2022).

## **2.4 Training Adaptation and Fitness Level Progression in Sedentary and Intellectually Disabled Population**

Large individual differences in the training adaptation have been reported in previous studies after standardized training. Tulppo et al. (2003) reported 2 to 9% range of individual changes in  $VO_{2max}$  after 8 weeks of moderate endurance training in sedentary participants. Buchheit et al. (2010) observed 2.5 to 25% range of changes in maximal aerobic speed and -2.1 to 17.5% range of changes in 10 km running time after 8 weeks of combined low-, moderate-, and high-intensity training (HIIT). Meanwhile, Vesterinen et al. (2016) also mentioned that 8 weeks of HIIT could significantly improve peak treadmill running speed. Regarding to the data recorded in ID projects, Ariffin et al (2020) found that there were  $9.1 \pm 36.8\%$  increase in vertical jump in exercise group but  $13.3 \pm 29.3\%$  significant reduction in jumping height in control group after 6 weeks of circuit training which revealed that 6 weeks of intervention could give significant improvement on muscular strength. Similarly, study by Ndayisenga (2019) also showed significantly increased cardiorespiratory fitness, leg muscle strength, and static balance at the end of the 6 weeks of intervention programme of the circuit training physical activity among intellectually disabled children. Besides that, balance training among adolescents with intellectually disabled by Lee et al (2016) showed significant improvements in the balance training group as compared to baseline; but postural balance and muscle strength showed no significant improvements in the control group after 8 weeks of postural balance and functional strength training. Furthermore, the results in Kim & Lee (2016) study indicated that the 12-week of circuit exercise program improved physical fitness, BAP levels and the d-ROM levels among adolescents with intellectual disabilities. Longer duration could give more benefit to their fitness

level. Zetts et al (1995) in their study, showed a progressive resistance exercise program on the productivity of individual simulation work among intellectually disabled individuals found a comparable percentage of muscle strength on the dominant and non-dominant muscle group. A subsequent study by Boer (2014) assessed the effects of sprint interval training for 15 weeks on metabolic and physical fitness in adolescents and intellectual disabled young adults showed a significant positive effect on waist circumference, percentage of fat, systolic blood pressure, lipid profile, fasting insulin, assessment of insulin resistance homeostasis models, VO<sub>2</sub> peaks, Watt tops, ventilatory thresholds, 6-minute walking distances and muscle fatigue resistance compared to control group. In this present study, the exercise programme will be conducted by using the online platform, thus by referring to Arrifin et al study, the researchers will increase the exercise programme to 8 weeks to monitor the participants' progression and give them more time to adapt to the training schedule.

#### **2.4.1 Effect of Exercise and Body Composition Among Intellectually Disabled Individuals**

Exercise has been shown to have a positive impact on body composition in intellectually disabled individuals. Intellectually disabled individuals are at a higher risk of obesity, cardiovascular disease, and other health problems related to poor body composition. Exercise helps to improve body composition by reducing body fat and increasing muscle mass.

Regarding to the data recorded in the study by Neto et al. (2010), the study was to examine the changes in body composition resulting from weight training

among individuals with Down Syndrome in 12 weeks; 3 × per week; 60 min/session. The results showed significant decrease of fat percentage in G1 (-2.0%,  $p = 0.036$ ) and absolute fat (-1.4kg;  $p = 0.000$ ). The controls presented unfavourable increase in fat percentage (+1.0%,  $p = 0.043$ ) and absolute fat (+0.8kg,  $p = 0.004$ ). Regarding lean mass (LM), besides, the effect of a physical fitness program on body composition and isometric strength in children with Down syndrome was reported by Ortiz-Ortiz et al.2019, which measured isometric handgrip strength, body height, weight, triceps, and the medial calf skin folds. The physical fitness program was performed for 16-weeks, five times per week, for 55-min sessions. The results showed significant pre- to post- intervention reductions in BMI in both EG ( $22.2 \pm 2.5$  vs.  $20.7 \pm 2.5$  kg/m<sup>2</sup>), and CG ( $23.3 \pm 4.9$  vs.  $21.9 \pm 4.6$  kg/m<sup>2</sup>). Similarly, the results reported to be statistically significant at pre- post-intervention in medial calf skinfold and isometric strength in the EG ( $14.9 \pm 5.5$  vs.  $14.6 \pm 3.2$  mm) and CG ( $2.4 \pm 4.0$  vs.  $9.2 \pm 2.0$  kg), respectively. Rosety-Rodriguez et al. 2013 in the study of resistance circuit training reduced inflammatory cytokines in a cohort of male adults with Down syndrome with six stations, 3 days per week for 12 weeks. Plasma levels of leptin, TNF- $\alpha$ , and IL-6 were significantly decreased after the completion of the training program, (as were fat-free mass and WC?). No sports-related injuries or withdrawals from the program were reported during the entire study period. No changes were observed in the control group.

Another study by Lipecki & Rutowicz, (2015) involved fifteen women. TANITA BC-1000 scale was used to assess their body weight and composition. The 10 weeks program was assessed twice. The strength and power of upper and lower body, the strength endurance of shoulders, shoulder girdle and trunk also flexibility were the chosen parameters in the study. The findings revealed that there was a

minor increase in body mass and body fat percentage. However, muscle mass and body water percentage were not changed. There were significant differences in aerobic capacity, strength endurance of trunk and lower body explosive strength. It is important to note that exercise programs for intellectually disabled individuals need to be tailored to their individual needs and abilities. This may involve modifications to the exercise program, such as using equipment that is easy to use or adapting exercises to be less complex.

#### **2.4.2 Effect of Exercise on Flexibility Among Intellectually Disabled Individuals**

Exercise has been shown to have a positive effect on flexibility in intellectually disabled individuals. Regular physical activity can improve range of motion, reduce muscle stiffness, and increase the overall flexibility of the muscles and joints. This in turn can improve mobility and reduce the risk of injury.

Wu et al. (2010) in the study of the effectiveness of healthy physical fitness programs in intellectually disabled individuals living in a disability institution: Six-month short-term effect, the study collected information on disability condition (type and level), height, weight, BMI, and physical fitness status (includes V-shape sit and reach test, sit-up 30 s, sit-up 60 s, and shuttle run) at the beginning and 6 months later of the program intervention. The results showed that there were statistical decreases in individual's weight, BMI score, BMI category, and positive improvement in V-shape sit and reach test, sit-up in 30 s and 60 s tests after 6-month interventions.

Another study by Son et al. (2016) suggested that walking exercise program should be offered to intellectually disabled individuals due to positive effects on muscular strength and flexibility and reduction on overall body composition values. In order to reap greater health benefits from the exercise program, a minimum of 300 minutes per week/ 100 minutes per session (WHO, 2012). According to a study (Hagner-Derengowska et al., 2015), cardio exercise utilizes 90% of all muscles (including lower and upper extremity muscles), strengthens the muscles and increases the stability of the upper segment of the spine. The results of this study support these findings as well, as evidenced by the fact that the participants' average