People living with Idiopathic Scoliosis

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ABSTRACT

Title: People living with Idiopathic Scoliosis

Introduction: Adolescent idiopathic scoliosis (AIS) affects the spinal curvature and may have an impact on the exercise tolerance of AIS patients. This study focused on comparing AIS patients' performance during the incremental shuttle walk test (ISWT) to a control group.

Methodology: Participants who attend the Orthopedic Outpatient Department (OOP) at Mater Dei Hospital (MDH) were recruited to perform two ISWTs, by walking around two cones 10 meters apart, with the pace set at increments by an audio signal played on a CD.

Data analysis: Data was collected before and after the ISWT. The recorded variables were distance walked, predicted maximal oxygen consumption (peak VO_2), heart rate, Borg scale, Rate of Perceived exertion (RPE), and oxygen saturation in the blood (SpO_2). This data was added to an excel sheet and analyzed through SPSS.

Results/conclusion: The results obtained showed a trend of decreased exercise tolerance in the Maltese AIS participants when compared to control groups as they demonstrated decreased distance walked and Peak VO_2, compared to age and gender matched control groups.

Key words: AIS / ISWT / Exercise Tolerance / Functional capacity

Table of Contents

List of Tables

List of Figures

List of Graphs

List of Abbreviations

Adolescent idiopathic scoliosis (AIS)

Incremental shuttle walk test (ISWT)

Incremental shuttle walk distance (ISWD)

Six-minute walk test (6MWT)

Six-minute walk distance (6MWD)

Predicted maximal oxygen consumption (Peak VO_2)

Maximal oxygen consumption ($VO_{2\ max}$)

Cardiopulmonary exercise testing (CPET)

Number of participants (n)

Mater Dei Hospital (MDH)

Orthopaedic outpatient (OOP)

Minimum clinically important difference (MCID)

Forced vital capacity (FVC)

Vital capacity (VC)

Volume of oxygen (VO_2)

Volume of exhaled carbon dioxide (VCO_2)

Rate of perceived exertion (RPE)

List of Appendices

CHAPTER 1 - INTRODUCTION

1.1 Definition of scoliosis

Scoliosis is derived from the Greek word “skoliosis”, which means “crooked”. The condition demonstrates a three-dimensional change in the spine portrayed by a minimum of 10-degree lateral deviation paired with vertebral rotation, and it is generally associated with a decrease in the natural kyphotic curvature. There are three types of scoliosis being; congenital, neuromuscular and idiopathic (Victoria Gacitúa *et al.* 2016).

This study will be focusing on Adolescent idiopathic scoliosis (AIS), which is the more common type of spinal deviation. The coronal, sagittal, and axial planes are all altered in thoracic AIS deformity. It affects 2% to 4% of adolescents, and this vertebral deformity accounts for about 80% of all idiopathic deformities (Altaf *et al.* 2013). Decreased functional capacity has been reported by Alves, Stirbulov and Avanzi, (2006) & Sperandio *et al.* (2014), showing that the respiratory mechanics are influenced by spinal deformity.

Also, previous studies which used the incremental shuttle walk test (ISWT), have shown decreased exercise tolerance of AIS patients (Sperandio *et al.* 2014) & (Sperandio *et al.* 2015). The outcome measure used in this study is the ISWT. It is a gradual and progressive test, along a 10-metre course following set audio with

beeps. Few studies have studied the exercise tolerance of AIS patients, and to this day, no studies have been conducted on Maltese patients.

1.2 Exercise tolerance

The ISWT is a test with a gradual and progressive increase in speed, and it also has strong repeatability (Singh *et al.* 1992; Parreira *et al.* 2014). The test can be conducted with safety and adequate tolerance in children and adolescents (Fernanda de Cordoba Lanza *et al.* 2019). The ISWT is a more accurate representation of everyday physical movements than cardiopulmonary exercise testing (CPET) (Hill *et al.* 2012; Zwerink *et al.* 2013).

1.3 The aim of the study

As the spinal curvature rotates, body mechanics may be affected. This study will examine exercise tolerance in adolescent idiopathic scoliosis participants with the use of the ISWT.

1.4 Research question

The research question is whether the scoliotic curve may have an effect on the exercise tolerance of adolescents with idiopathic scoliosis.

1.5 Hypothesis and Null Hypothesis

This Hypothesis is, “Adolescents living with idiopathic scoliosis have a reduced exercise tolerance when compared to a control group”.

Therefore, the Null Hypothesis is, “Adolescents living with idiopathic scoliosis do not have a reduced exercise tolerance when compared to a control group”.

1.6 Relevance to the Physiotherapy profession

The results may give physiotherapists a better understanding of the exercise tolerance of the patients who have idiopathic scoliosis. However, since the sample size was small (n = 10), the results will only show a trend. One part of the holistic approach in treating scoliosis by physiotherapy would be to address exercise tolerance during sessions by prescribing walking or running routines.

1.7 Dissertation outline

The introduction gives a brief explanation of the study, looking at exercise tolerance in AIS patients. The literature review encompasses similar literature already conducted in other countries, which were compared to this study. The methodology explains the ethical procedures, limitations posed by the methodology itself, and the data collection procedure. Lastly, the results and conclusion record the participants’ performance, discuss and compare findings with other studies and explain the contribution of this study to the profession and the need for further research.

CHAPTER 2 – LITERATURE REVIEW

2.1 Keywords used, Search Strategies and Prisma

The literature search was done using Pubmed for the English language between 2000 and 2020 to gain more knowledge regarding exercise tolerance of adolescents who have idiopathic scoliosis. Filters and keywords were added to narrow the search.

Key words used:

- Adolescent idiopathic scoliosis
- Exercise tolerance
- Functional capacity
- ISWT
- Incremental shuttle walk test
- 6MWT
- 6-minute walk test
- Exercise limitation

Subsequently after identifying the key words, synonyms or abbreviations were searched using a thesaurus. These include “exercise tolerance”, “functional capacity” and “exercise limitation”, “Incremental shuttle walk test” and “ISWT”, “Adolescent idiopathic scoliosis” and “AIS”. Boolean operators were also used in the

search with keywords and synonyms and these included (AND) to expand the search, (OR) to narrow the search and (NOT) to exclude words.

Studies included had to include:

1. An exercise tolerance test
2. Adolescents aged 10 - 18
3. Suffering from idiopathic scoliosis

The title of the study and the abstract were evaluated taking into consideration the inclusion criteria. Further studies were found from the reference list of the identified studies and were also included in the literature search.

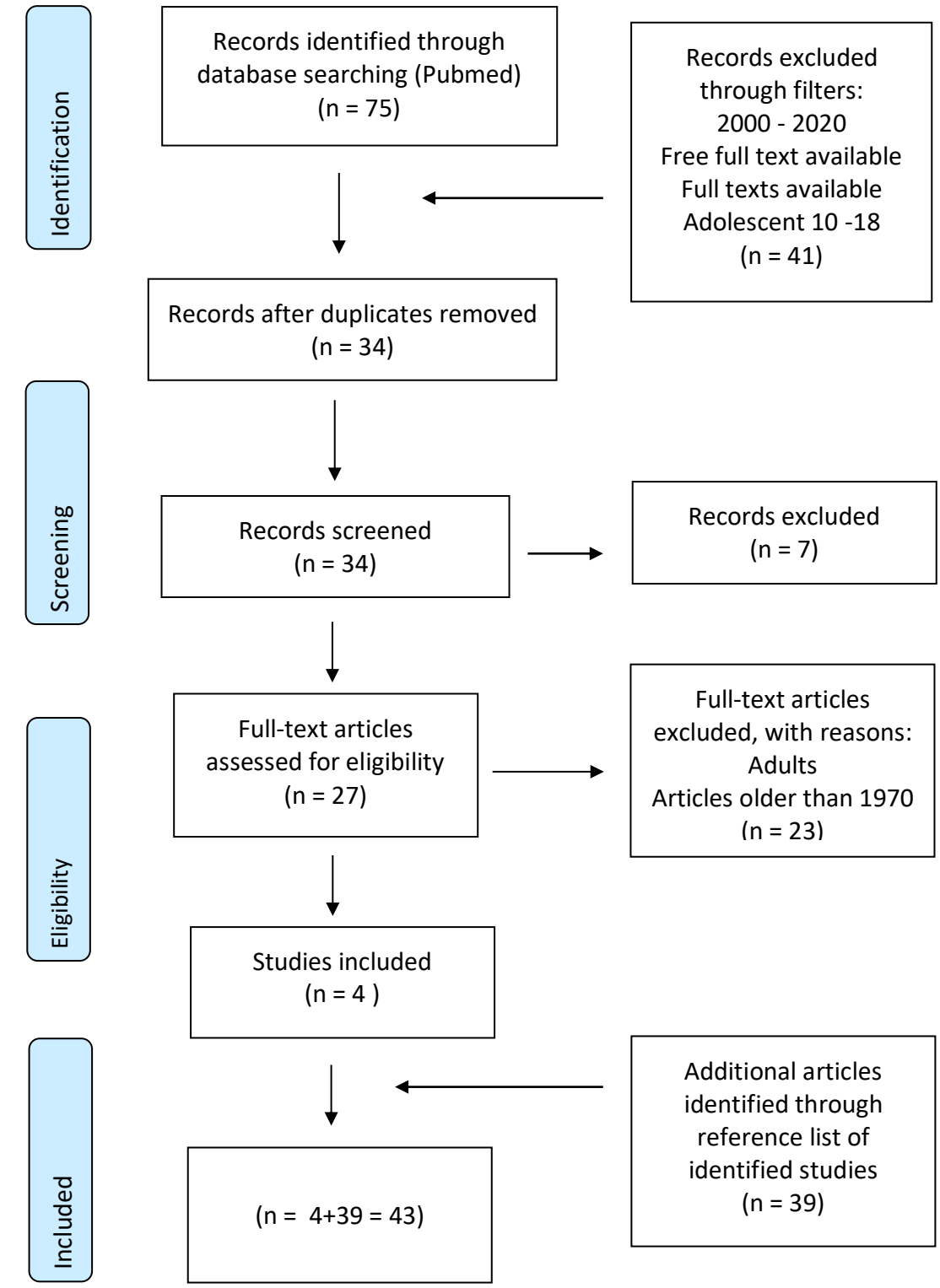


Figure 2.1 - PRISMA Flow chart

Author, year and country of origin	*Title*	*Sample: Number of Participants*	*Findings*	*Strengths and limitations*
Vishnu Vardhan et al. 2018 India	Normative values of incremental shuttle walk test in children and adolescents: An observational study	n = 180	This study established the normal values of incremental shuttle walk distance	Strengths – Both genders were included. Limitations – Small sample size, unequal gender distribution between groups, unequal number of subjects in different age group, 1 ISWT performed
Evandro F. Sperandio et al. 2014 Brazil	Functional aerobic exercise capacity limitation in adolescent idiopathic scoliosis	n = 49	Patients with AIS reported a substantial decrease in exercise tolerance. This was linked to a decrease in lung activity and a change in breathing rhythm during the test.	Strengths – 2 ISWT were performed Limitations – Small sample size, CPET was not performed in order to compare the variables collected from the ISWT, kyphosis angle was not measured

Table 2.1 – Search strategy

Author, year and country of origin	*Title*	*Sample: Number of Participants*	*Findings*	*Strengths and limitations*
Saraiva et al. 2018 Brazil	Impact of Scoliosis Severity on Functional Capacity in Patients with Adolescent Idiopathic Scoliosis	n = 66	The study found that larger Cobb angles have a considerable effect on exercise tolerance, pulmonary function and muscle strength of the respiratory system	Strengths – 2 ISWT performed, evaluated different quantifications of Cobb angles Limitations – Small sample size, CPET was not performed in order to compare the variables collected from the ISWT
Evandro F. Sperandio et al. 2015 Brazil	Functional exercise capacity, lung function and chest wall deformity in patients with adolescent idiopathic scoliosis	n = 27	This study found that peak VO_2, VE_{max}, and ISWD correlated with the shape of the chest wall as well as with the lung function in AIS patients. This indicated the effect of the curvature on the shape of the chest during the exercise tolerance test.	Strengths – The study included both pre-operatively and post-surgical treatment of spinal arthrodesis Limitations – Small sample size, Cobb angle was not measured, patients were clustered together as they were in different stages of disease in order to increase sample size, CPET was not performed in order to compare the variables collected from the ISWT

Table 2.2 – Search strategy

2.2 Exercise tolerance of Adolescents living with Idiopathic Scoliosis

Scoliosis is defined as a spine deviation of more than 10 degrees in the coronal plane (Victoria Gacitúa et al. 2016). Several studies have looked at whether exercise tolerance is impacted in scoliotic patients. Sperandio *et al.* (2014) conducted a study using the ISWT to assess the physiological responses of AIS patients. In this study, the ISWT was performed twice, and the results showed a significant reduction in incremental shuttle walk distance (ISWD) and predicted maximal oxygen consumption (Peak VO_2) during the ISWT when compared with a control group. The participants were aged between 11-18 years; eighteen of them had moderate scoliosis, eight had severe scoliosis, and three had mild scoliosis. The results showed that participants had problems associated with impaired breathing pattern and reduction in pulmonary function while walking. However, one of the limitations of this study was that they did not provide a sufficient number of scoliosis patients in order to assess exercise capacity in various scoliosis severities.

Dos Santos Alves and Avanzi, (2009) performed the six-minute walk test (6MWT) to assess AIS patients' cardiorespiratory function objectively. A decrease in distance covered and oxygen saturation (SpO_2) was noted in their results. Moreover, there was a significant increase in Borg scale scores of adolescents with idiopathic scoliosis compared to the control group matched by age and gender.

Barrios *et al.* (2005) evaluated cardiopulmonary function restrictions in adolescents with mild and moderate scoliosis and found reduced maximal oxygen consumption

($VO_{2\ max}$) concluding that although at rest, there were no restrictions in respiratory function, participants had lower maximal tolerance to exercise. They performed incremental walking on a motor-driven treadmill and allowed the participants to run as the test progressed. Barrios *et al.* (2005) continue to say that other studies have already found limited cardiopulmonary function (Chong et al. 1981; Kesten *et al.* 1991), the studies tested patients with a Cobb angle greater than 60°. Also, reduced functional capacity was also observed in adults with moderate scoliotic curves averaging 47° in the study by Kesten *et al.* (1991).

Changes in the distortion of the chest wall, function of the lung and exercise tolerance, in patients who have AIS were studied by Sperandio *et al.* (2015). A manometer was used to carry out a respiratory assessment by measuring the maximum inspiratory and expiratory pressure, while a handheld spirometer was used to measure spirometry readings. For this study's purpose, the ISWT was performed twice, as was performed by Singh *et al.* (1992).

Singh *et al.* (1992) conducted a study to develop a shuttle walking test targeting patients who have chronic airway obstruction. They aimed to create an externally paced field test where the participant would not be able to self-pace. It was also designed to be a gradual and progressive test. Participants eligible for participation were aged between 45-74 years and included both genders. The ISWT and 6MWT results were compared, and showed a significant relation in the distance walked between both tests. However, during the ISWT, the cardiovascular system increased gradually, which was not noticeable in the 6MWT. The maximum heart rates were

also significantly higher for the ISWT than for the 6MWT. Singh *et al.* (1992) tested the test's reproducibility by comparing the distance walked during the three trials. The results show that the ISWT is reproducible after one practice. Parreira *et al.* (2014) conducted a systematic review to assess the validity and reliability of the ISWT. The 21 studies that were evaluated, concluded that the ISWT is a reliable and valid test to assess maximal exercise capacity in participants with chronic respiratory disease.

Sperandio *et al.* (2015) reported a decrease in predicted maximal oxygen consumption (Peak VO_2) and demonstrated a correlation between distance walked and Peak VO_2 variables with the shape of the chest wall, lung capacity and maximal respiratory pressures. A limitation of the study by Sperandio *et al.* (2015) was that the patients' Cobb angle was not recorded. Therefore, participants could not be compared according to the degree of their scoliotic curve. Also, since the sample size was small, the participants had to be clustered into one group, so comparisons between pre and post-operative patients were not studied. Two groups would have been a better choice as one group would have been pre-operatively and the other post-arthrodesis, to show any differences between the inefficiency of the respiratory pattern (Newton *et al.* 2005) or highlighting the compensation for the low tidal volume (Barrios *et al.* 2005; Martínez-Llorens *et al.* 2010). Moreover, both studies hypothesised that the respiratory rate has to increase to compensate for the increased oxygen demand due to the limitation of the diaphragmatic incursion.

Two studies conducted by Boyer *et al.* (1996) & Newton *et al.*(2005) explained the diaphragmatic incursion limitation. The former conducted a study on AIS patients to find airway obstruction, while the latter performed pulmonary function testing in preoperative AIS patients. Both studies showed that maximum ventilation was still reduced even though the respiratory rate was increased, displaying the inefficiency of mechanical ventilation of scoliosis patients.

Furthermore, DiRocco and Vaccaro, (1988) assessed participants with a mean scoliotic curve of 21.5° and found lower forced vital capacity. A continuous graded incremental exercise tolerance test on a treadmill was used to measure the patients' work capacity in their study.

The greater the severity of the scoliotic curve, the distance walked decreased; hence an inverse correlation was noted in the study of Saraiva *et al.* (2018). During the test, the participants could breathe through a facemask with a minimum dead space using a gas analyzer. Another physiological change noted in AIS patients was a reduction in quadriceps strength (Martínez-Llorens *et al.* 2010); this may also contribute to the lower results found in AIS patients compared to control groups.

2.3 Exercise Capacity and Severity of Cobb angle

Saraiva *et al.* (2018) demonstrated that as the Cobb angle increased > 45°, the distance walked decreased compared to the control group matched for age and gender and with participants whose Cobb angle was < 45°, displaying reduced functional capacity of adolescents with idiopathic scoliosis. Chong et al. (1981) also

found that the functional capacity decreased with a greater Cobb angle; however, Barrios *et al.* (2005) did not correlate the lower $VO_{2\ max}$ to a greater Cobb angle.

Furthermore, curves of 24°- 40° were also studied by Czaprowski *et al.* (2012), and lower values of $VO_{2\ max}$ were also noted compared to the mild group (10°- 24°) and control group. The study consisted of performing the Physical Work Capacity 170 (PWC170) test on a cycle ergometer based on two 5-minute sub-maximal physical effort events. On the other hand, similar $VO_{2\ max}$ among healthy participants and participants with mild scoliotic curves was noted by Leech *et al.* (1985), where participants performed a simplified submaximal exercise test on a bicycle ergometer. They noted a decrease in $VO_{2\ max}$ in the group >25°. The results indicated no correlation between mild scoliosis and functional capacity. The results of Sperandio *et al.* (2014) were not correlated with the scoliotic curve's severity. The three studies performed a maximal exercise test, with the participants being girls; however, boys were also included in the study by Leech *et al.* (1985). Therefore, it is still unclear whether the severity of the Cobb angle causes lower exercise tolerance.

As mentioned above, previous studies by Sperandio *et al.* (2014) and Sperandio *et al.* (2015), had insufficient scoliosis patients. This time Saraiva *et al.* (2018) recruited more participants to increase the sample size. This enabled the researchers to form two groups, divided depending on the Cobb angle's degree, to analyse the effect of scoliosis severity on the distance walked. The results demonstrated that the higher the severity of scoliosis, i.e. as the Cobb angle increases, the distance walked by the

participants decreases, coming into agreement with the study of Chong et al. (1981).

Respiratory muscle strength has shown to be reduced in scoliosis patients (Barrios *et al.* 2005; Sperandio *et al.* 2014), highlighting the hypothesis that respiratory muscle strength may be influenced proportionally by the severity of the Cobb angle.

Takahashi *et al.* (2007) noted in their study that the dimensions of the rib cage might alter depending on the severity of the Cobb angle. This change in the rib cage dimensions may lead to decreased pulmonary function correlating with the chest's diameter, total lung area, and acquired vertebral rotation.

Dos Santos Alves and Avanzi, (2009) stated that different organs such as the lungs and the heart were affected by deformity of the spinal curvature due to scoliosis, and the progression of the curve may weaken exercise performance. Nonetheless, this statement was argued against by Saraiva *et al.* (2018) as the results demonstrated lower heart rates and oxygen saturation in patients with a Cobb angle >45°, stating that these results may be due to decreased distance walked during the test. Therefore, participants were unable to reach maximum potential when they were compared with the control group.

Borowitz, Armstrong and Cerny, (2001) performed a case study on a patient with a Cobb angle of 115°. Pulmonary function tests were performed before and post-surgical correction. The Cobb angle was improved to 45° after the surgery.

Pulmonary function tests improved after the surgery, and they stated that due to the progressive curvature, bronchi and the surrounding structures might be compressed because of the alteration of the chest wall.

2.4 Effect of Surgery and Exercise rehabilitation on Exercise Tolerance

Singh *et al.* (2008) conducted a study to find the minimum clinically significant improvement for the ISWT. They recruited 372 participants with a mean average age of 69 years. Participants had to perform the ISWT before and after a 7-week pulmonary rehabilitation programme. They concluded that a 5-shuttle difference accounting for 48m is a reliable threshold to determine an improvement by treatment.

Researchers have studied any changes in exercise capacity post-spinal correction. A study by Lenke *et al.* (2002) observed that reduced ventilatory reserve was not reversed by surgery.

Alves, Stirbulov and Avanzi, (2006) provided a rehabilitation protocol for AIS patients for four months. After the rehabilitation program, the results found rehabilitation beneficial as the results showed improved pulmonary capacity during the 6-minute walk test when the results were compared with the results before the rehabilitation program commenced. This showed that pulmonary function improved regardless of the Cobb angle. This study allowed the participants to run

rather than walk during the test. Moreover, the test consisted of 15 levels rather than the 12 levels found in the modified protocol by Singh *et al.* (1992).

Athanasopoulos *et al.* (1999) studied AIS female participants aged 13 years with a mean average Cobb angle of 27.4°. The participants were enrolled in an 8-week aerobic training programme, and the results were compared to a non-training control group which involved girls aged 13 years with a mean average Cobb angle of 29°. The results showed a significant improvement in pulmonary function after the 8-week programme, while the control group had decreased forced vital capacity (FVC) and vital capacity (VC) during those two months.

2.5 Hypothesis regarding decreased Exercise Tolerance

There is still no conclusive evidence regarding the cause of the decreased exercise capacity of adolescents who have idiopathic scoliosis. Barrios *et al.* (2005) concluded that the cause of the decreased exercise tolerance was chronic deconditioning, while Martínez-Llorens *et al.* (2010) confounded it on the occurrence of peripheral muscle dysfunction.

Reduction in functional capacity during walking was associated with an impaired breathing pattern (Sperandio *et al.* 2014) and abnormal ventilation (Leong *et al.* 1999). They concluded that these causes were either due to reduced inspiratory muscle strength or an abnormal shape and rib cage movement. Besides, stiffness of

the chest's upper extremity was noted, which may have exhibited an effect on functional capacity.

Kesten *et al.* (1991) attributed the decreased fitness level and low self-esteem to the participants' physical appearance, while Schwieger *et al.* (2016) stated that participants who had Cobb angle >40° had significantly poorer body image leading to decreased physical activity.

Participants with idiopathic scoliosis had increased respiratory rate (Sperandio *et al.* 2014), indicating the inefficiency of the respiratory pattern. This may be the compensation for the low tidal volume (Barrios *et al.* 2005; Martínez-Llorens *et al.* 2010). Furthermore, both Barrios *et al.* (2005) and Martínez-Llorens *et al.* (2010) hypothesised that due to the limitation of the diaphragmatic incursion, the oxygen demand is higher and therefore in order to compensate the respiratory rate increases.

Sperandio *et al.* (2015) found a correlation between some variables; distance walked during ISWT, Peak VO_2 and $VO_{2\ max}$ with shape of the chest wall, lung capacity and maximal respiratory pressures. Based on the results, it was hypothesised that due to the alterations of the chest wall, there might be possible restrictions to activities of daily living.

Saraiva *et al.* (2018) stated that more advanced stages of the ISWT might be harder to reach by participants who have idiopathic scoliosis as they were unable to reach

the target at the set time. This was demonstrated in the results as the distance walked was shown to be decreased as the test progressed.

2.6 Exercise tolerance measurement

For the purpose of this study, the incremental shuttle walk test was chosen to be the outcome measure for data collection.

2.7 Outcome measures of Exercise Tolerance and normative values

Numerous studies used different outcome measures to test patients' exercise tolerance; these include the 6-minute walk test, ISWT, endurance shuttle walk test, and cardiopulmonary exercise testing, which are rather demanding and used for younger patients. Other outcome measures for exercise tolerance include the five times sit to stand, 30 seconds sit to stand and 2-minute walk test, these three tests are usually performed on older patients.

The methods of performing the test vary between studies; Martínez-Llorens *et al.* (2010) and Czaprowski *et al.* (2012) performed CPET on a cycle ergometer, while Barrios *et al.* (2005) and DiRocco and Vaccaro, (1988) used a motor-driven treadmill to perform the test and collect the data. Some studies performed the ISWT through field tests (Sperandio *et al.* 2014, 2015; Saraiva *et al.* 2018).

Numerous studies have come forward to compare different outcome measures. The ISWT showed a better reflection of exercise capacity in cystic fibrosis (Saglam *et al.* 2016) as it elicited higher heart rates and dyspnoea scores and lower oxygen saturation than the 6MWT. Functional capacity using both the ISWT and the 6MWT were studied by Pulz *et al.* (2008) and Costa *et al.* (2018). Pulz *et al.* (2008) conducted the study on patients with chronic heart failure, while Costa *et al.* (2018) performed the tests on patients with Chagas heart disease. Both studies concluded that the ISWT showed similar results of Peak VO_2 when compared with the 6mwt. Costa *et al.* (2018) stated that during the 6MWT, participants tended to walk at a comfortable speed throughout the test; on the other hand, during the ISWT, participants had to increase their pace after every minute to compensate for the increase in speed after every minute.

Also, although the 6MWT is considered an intense test by Sperandio *et al.* (2015), a study by Onorati *et al.* (2003) evaluated the gas exchange between both the ISWT and 6MWT in chronic obstructive pulmonary disease patients, concluding that the ISWT provoked significant higher results of volume of oxygen uptake (VO_2), volume of exhaled carbon dioxide (VCO_2) and $VO_{2\ max}$ compared to 6MWT.

Dourado *et al.* (2013) performed the ISWT on participants aged 40 years and older. The results concluded that the kinematics of the physiological variables of the ISWT are similar to those described in CPET. These include Peak VO_2, which was higher in the shuttle walk test when compared with the results of Neder *et al.* (1999), who tested participants aged 20 to 80 years by using CPET. If the study by Dourado *et al.*

(2013) used CPET in addition to the ISWT, then both the results of ISWT and CPET would have been compared against each other, coming out with similarities and differences. Moreover, Singh, (2007) supports the study of Dourado *et al.* (2013) as they correlated the ISWT and CPET, claiming both tests are suitable for evaluating the functional capacity in adults with chronic disease. The ISWT is an easy test to explain and perform, cheap since it requires simple equipment and is not time-consuming to assess the participants' exercise tolerance.

A study by Vardhan *et al.* (2017) attempted to provide reference values for the ISWT for girls and boys, following the method described by Singh *et al.* (1992). Their study, stated that the ISWT was initially designed for adults and has been less explored on children and adolescents. The reference values were obtained and showed; increased height and age resulted in increased distance walked and higher Peak VO_2 values.

2.8 Learning effect of the incremental shuttle walk test

Several studies have emphasized the importance of practising the test before taking the actual reading; as stated in the studies by Singh, (2007), Sperandio *et al.* (2015) & Saraiva *et al.* (2018) as participants tend to have a learning effect for the first try and can walk further in the second try.

Singh, (2007), performed the modified ISWT three times; and showed a significant difference between the first and second test; however, there was no significant

difference between the second and third test. Moreover, to minimize the learning effect, Sperandio *et al.* (2015) performed the test twice and found a difference of about 20 meters of distance covered in the second test compared with the first test. This was also noted by Saraiva *et al.* (2018) as the second test was a better evaluation of the participants' exercise capacity.

Dyer *et al.* (2011) conducted a study regarding the necessity of performing a second ISWT on adults and found that about 65% of the participants walked more in the second test.

2.9 Lack of evidence and research

A limited number of studies observed and studied the exercise tolerance of adolescents with idiopathic scoliosis from the literature review. The studies were chosen depending on the functional test used in the study; in this case, the ISWT. However, other tests' results were also evaluated as research on the ISWT specifically performed on adolescents is limited.

2.10 Summary

Most studies concluded that exercise tolerance was reduced in adolescents idiopathic scoliosis participants compared to control groups. Some studies correlated scoliosis severity with decreased exercise tolerance of adolescent idiopathic scoliosis patients. Nonetheless, this decrease in exercise tolerance may

be due to several factors, as so far, there is not enough research to determine the primary cause. More research has to be conducted to examine exercise tolerance further and distinguish the reduction of functional capacity in adolescents with idiopathic scoliosis. Lastly, the ISWT is a valid and reliable outcome measure, a cheap and straightforward data collection method. The data collection procedure, including aims, and analysis will be discussed in the next chapter.

CHAPTER 3 - RESEARCH METHODOLOGY

3.1 Aim

This study aims to assess the exercise tolerance of adolescents who have idiopathic scoliosis, comparing the findings with trends found in other countries (Brazil and India) and also with a control population. The results will not extrapolate to the general scoliosis population in Malta. However, it will indicate a trend that might be of value if further investigated.

3.2 Study design

This study focuses on the research question of whether any variations in the scoliotic curve may affect the exercise tolerance of adolescents with idiopathic scoliosis.

It explores the following variables:

- Distance walked
- Peak VO_2
- Heart rate
- Borg scale
- Rate of perceived exertion (RPE)
- Saturation of oxygen in the blood (SpO_2)

For data collection, a “pilot study” design was selected. By using this type of design, the researcher chose the required participants depending on their disorder rather than using the randomisation process (De Poy and Gitlin, 2015). The participants

studied were females aged 10-18, suffering from AIS and attending the orthopaedic outpatient department (OOP) at Mater Dei Hospital (MDH). In comparison with other more robust methods, this design was used as pilot information. It was cost-effective since it only required cheap and simple equipment to carry out the testing (De Poy and Gitlin, 2015).

3.3 Ethical approval

Ethical approval was granted before the data collection initiation from; the University of Malta Faculty of Research Ethics Committee (FREC) of Health Sciences and the University Research Ethics Committee (UREC) refer to Appendix 1.

3.4 Inclusion criteria

The inclusion criteria consisted of the following points so as to be eligible to participate in the study:

- Only scoliosis patients suffering from AIS were included
- Aged from 10 to 18 years
- Attending the OOP department at MDH
- Physically active patients' and those who are not were both included
- Gender: only females were asked to join this study

3.5 Exclusion criteria

The following points were used as exclusion criteria:

- History of heart, lung or neuromuscular problems

- Patients' suffering from other forms of scoliosis such as congenital, neuromuscular.
- Aged >18 years
- Aged <10 years
- Gender, boys were excluded from this study
- Patients who have already undergone corrective surgery

3.6 Recruitment of participants

A convenient sampling method (Hicks, 2009) was used to recruit participants. This approach employs inclusion and exclusion criteria to choose the most eligible participants, who are pleased to participate (De Poy and Gitlin, 2015). This sampling strategy is efficient as it saves money, effort and time (Polgar, 2013).
Moreover, one type of non-probability sampling is known as convenient sampling which is limited by the use of inclusion and exclusion criteria (Jackson, 2017).

Females between the ages of 10 and 18, who have AIS and attend OOP department at MDH were chosen as participants. Before the commencement of the recruitment process, consent and approvals were obtained from the CEO of MDH, the Orthopaedic surgeon at MDH and the Orthopaedic nurse at OOP Department at MDH in order to be granted access to the participants.

The intermediary recruited the participants according to the inclusion and exclusion criteria. Before distributing the letters, the intermediary explained the aim of the

study, in brief, ensuring the participants and their guardians understood the study's procedure. The letters included a detailed information letter and a consent form in both English and Maltese and exclusion criteria. The exclusion criteria consisted of various conditions which are contraindicated in this study. The participants and guardians signed the papers, and the primary researcher was informed of the participants. The researcher got the go ahead to set up meetings with the individual participants and their guardians. Participants agreed to participate and were given a brief description of what the study entails.

3.7 Methodological limitations

The weather was one unpredictable limitation since data collection was carried out outdoors; one meeting with the participants had to be cancelled due to rain. Moreover, due to the Coronavirus pandemic, only urgent cases were given appointments at the OOP department at MDH to reduce contact between people; therefore, participants' recruitment was limited. Some participants rejected the study due to concern about possible exposure to the virus since they had to meet with the primary researcher. Therefore data collection had to be postponed from September-October since at that time there were no participants who approved. However, data collection was carried out during January and February. Another limitation was that a ontrol group was not used, and the Maltese participants' results had to be compared with the results of other studies from Brazil and India.

3.8 The Incremental shuttle walk test

The ISWT was used to assess the exercise tolerance of the participants. This test is reliable and valid, as stated by (Parreira *et al.* 2014); it is also convenient for both participant and researcher as it is an easy and cheap method of assessing exercise tolerance with minimal risk of injury.

3.9 Data Protection Procedure

Throughout the study, confidentiality was maintained as data was only limited to the intermediary and the primary researcher, and also any data collected during the study was only used for the benefit of this research. Also, data collected was stored securely on a laptop, protected by a password, and pseudonymised by adding a reference number instead of the name, which the researcher only accessed. Access to such data was only available to the researcher for verification. Any further personal information was not mentioned or revealed in reports, presentations, or publications that arose from this research. Once the research is completed, all personal data gathered will be destroyed without the possibility of recovery.

According to the General Data Protection Regulation (GDPR) and national legislation provisions, participants had the right to view, amend, and eliminate all data regarding them. The participants had the right to withdraw from the study at any point and time, without notice and prejudice.

3.10 Data Collection

Participants who were eligible for this study and satisfied the inclusion criteria were referred to the primary researcher by the intermediary. A meeting was then arranged. Firstly, queries regarding the study were answered, and the study was explained by the researcher to confirm that the participants and their guardians understood the study's procedure and what it entails. The signed information letters and consent forms were collected.

Data Collection was carried out at the University of Malta track, ensuring social distancing and an open environment. The guardians and a qualified physiotherapist had to be present for supervision purposes during the whole session. The ISWT was used to obtain the required data. This method was based on the study by (Singh *et al.* 1992), who modified the ISWT to 12 levels. This test requires the participants to walk a 10m course. The course was established by placing two cones of 0.5m from either end to avoid sudden changes in direction, as seen in Figure 3.1. Chairs were also placed at either end of the course for safety purposes. These chairs were made available for participants' to use if they felt the need to rest due to exhaustion or other complaints such as dizziness. Previous studies have not reported any adverse reactions, but the chairs were just precautionary. The test would be stopped if the participants rested since they would be unable to reach the cone in time.

An audio signal dictated the tests' speed, and the participants had to walk up to the cone before the beep. The speed increased by 0.17m/s after every minute. The test would be stopped if the participant was too exhausted to maintain the required

speed or if the heart rate exceeded the maximal safe heart rate of 85%. Maximum heart rate was calculated by using the Karvonen formula of [(max HR – resting HR) × % intensity] + resting HR. The maximum heart rate for each participant was measured by using the formula 220 – age.

Anthropometric measurements of height and weight were collected before the commencement of the test. Upon arrival, the participants were given a number, and all data collected were inserted in a separate file referenced under the corresponding number. A pulse oximeter was attached to the participants' index finger, recording the heart rate and oxygen saturation. Participants were asked to quantify their breathlessness via the Borg scale (0 - 10) (Kendrick, Baxi and Smith, 2000) and exhaustion via the Rate of perceived exertion (6 - 20) (Cleland *et al.* 2016) before and after the completion of the test.

Figure 3.1 - The incremental shuttle walk test course

3.11 Standard Anthropometric measurements

- Age
- Height (m) – Measured by the use of a height stadiometer

- Body Mass (KG) – Measured using a Tanita scale and wearing the clothes and footwear used during the test.
- Cobb angle (°) – this measurement was collected from the guardians who received the consultant's information at OOP, MDH.

3.12 Measurements and equipment used

- Height stadiometer
- Weighing scale
- SpO_2 – using a pulse oximeter attached to the index finger or thumb
- Heart rate - using a pulse oximeter attached to the index finger or thumb
- Breathlessness – Borg scale and Rate of perceived exertion

The participants were then shown the course where the test was to be carried out. The participant was asked to walk along the course according to the beeps on the audio signal. For the first minute, the primary researcher walked alongside the participant to establish the test's routine. After the first minute, the researcher stood at the side and, after every minute, advised the participant to slightly increase the walking speed without giving any additional encouragement. After completing the test, the participant sat down on the chair, rested for 30 minutes and then performed the second ISWT test.

3.13 The data collection procedure

- SpO_2 measured before and after the test

- Heart rate measured before and after the test
- Borg scale and Rate of perceived exertion scores described by the patient before and after the test.
- Laps covered were recorded by the researcher and supervising physiotherapist.

Peak VO_2 was calculated after data collection was finished by using the equation; VO_2 Peak = (4.19+ 0.025(distance) ml/min/kg) (Vardhan *et al.* 2017). This equation give a predicted maximal oxygen consumption by the participant.

3.14 Analysis of data

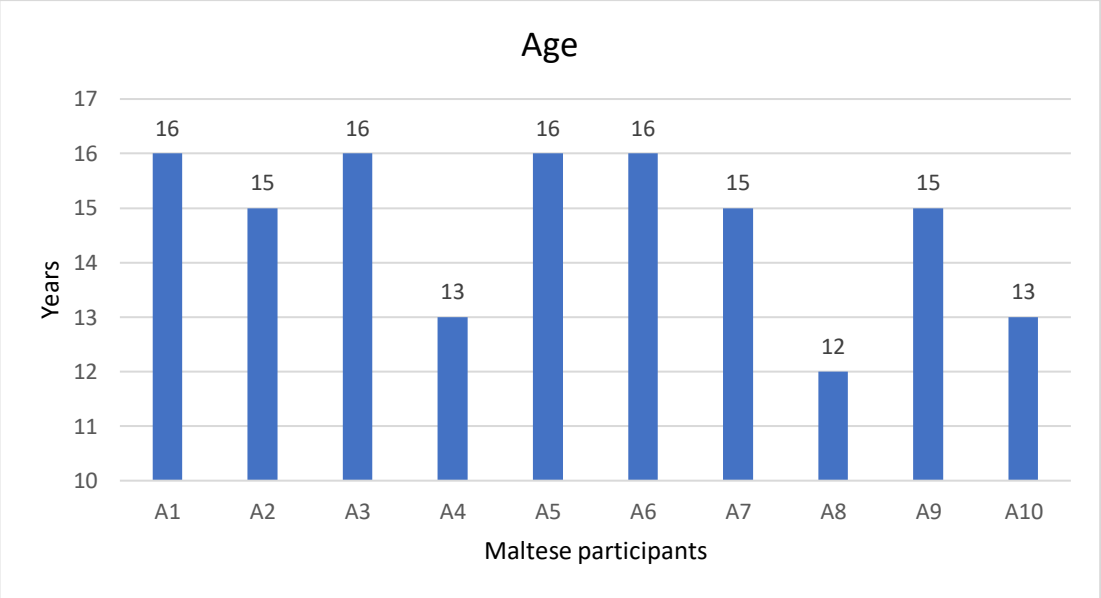
Data were analysed using three statistical tests in order to find normality, equality and correlations between variables. Normality testing was checked using the Shapiro-Wilk test as was used in the study by Vardhan *et al.* (2017). Since all outcome measures resulted in being normally, the One sample t-test analysis was computed for data analysis; to compare mean results from other studies since they only provided the mean score in their results. Correlations between variables were analysed using the Pearson rank of correlation as was performed by Sperandio *et al.* (2014). The probability of alpha error was set at 5%.

CHAPTER 4 - FINDINGS AND DISCUSSION

A total of 10 participants aged 12 to 16 years were recruited from the orthopaedic outpatient department at MDH. Anthropometric measurements were collected before testing. This data including; height, weight and Cobb angle measurements, measurements which were documented as seen in Table 4.1.

4.1 Findings

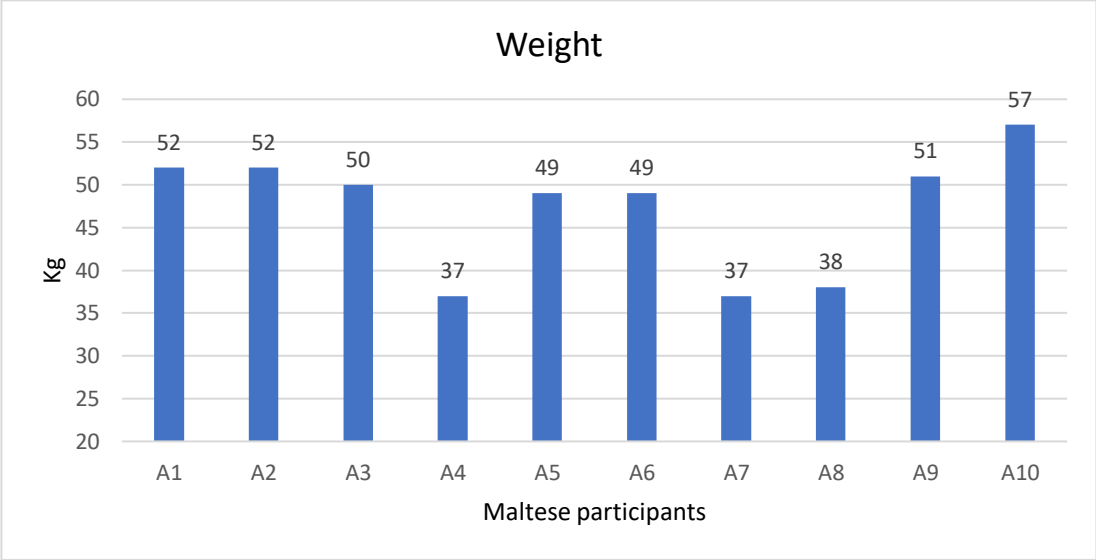
Age



Graph 4.1 - Age of Maltese AIS participants

The age of the Maltese AIS participants ranged from 12 years to 16 years. The mean average age was 14.7 years.

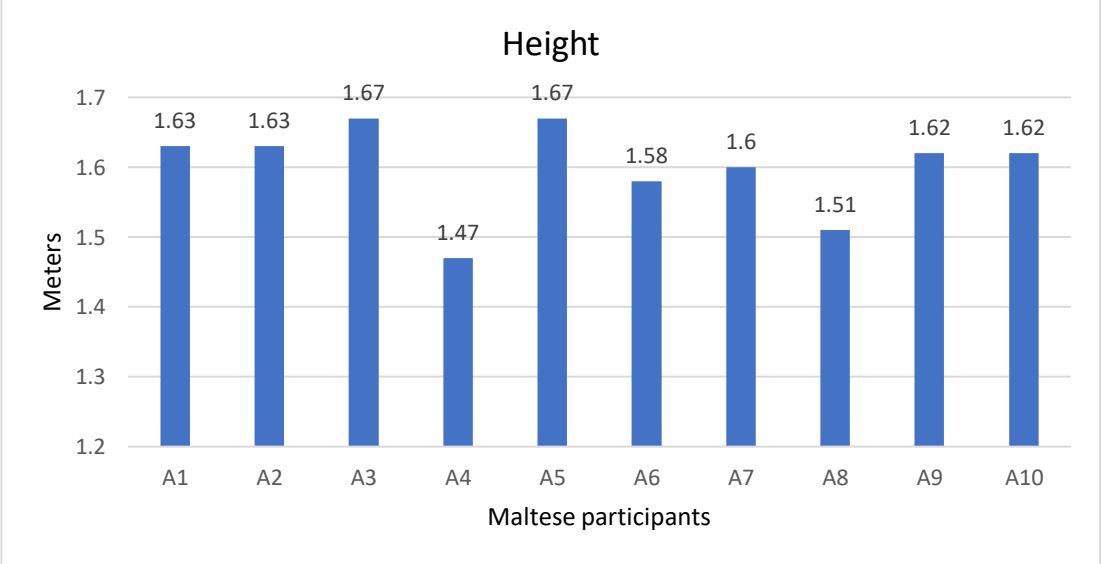
Weight



Graph 4.2 - Weight of Maltese AIS participants

The Maltese AIS participants' weight ranged from 37 kg to 57 kg, with a mean average of 47.2 kg.

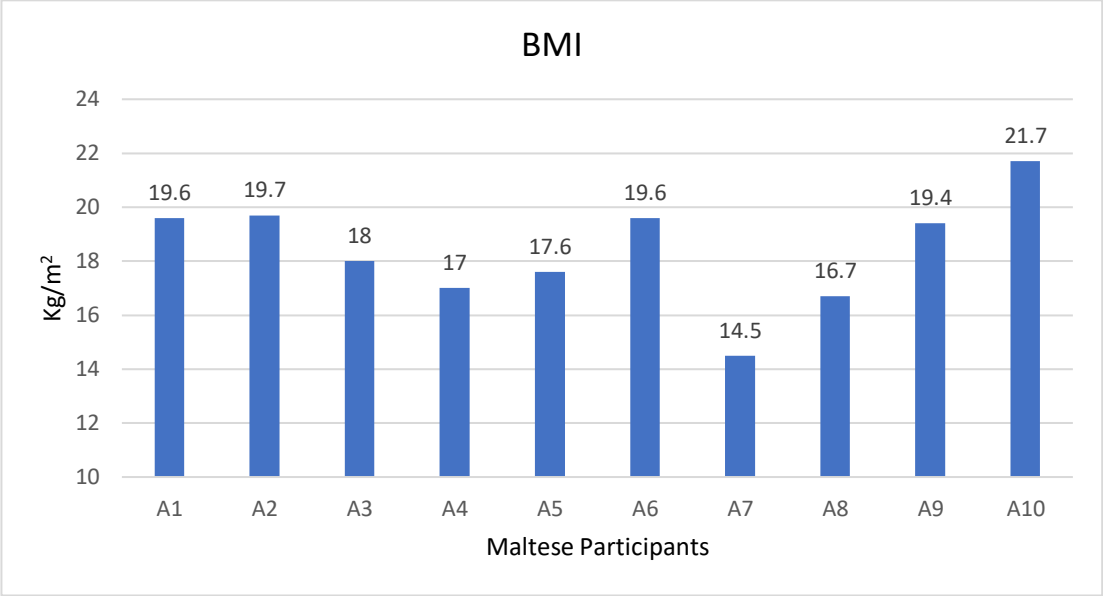
Height



Graph 4.3 - Height of Maltese AIS participants

The Maltese AIS participants height ranged from 1.47m to 1.67m, with a mean average height of 1.60m.

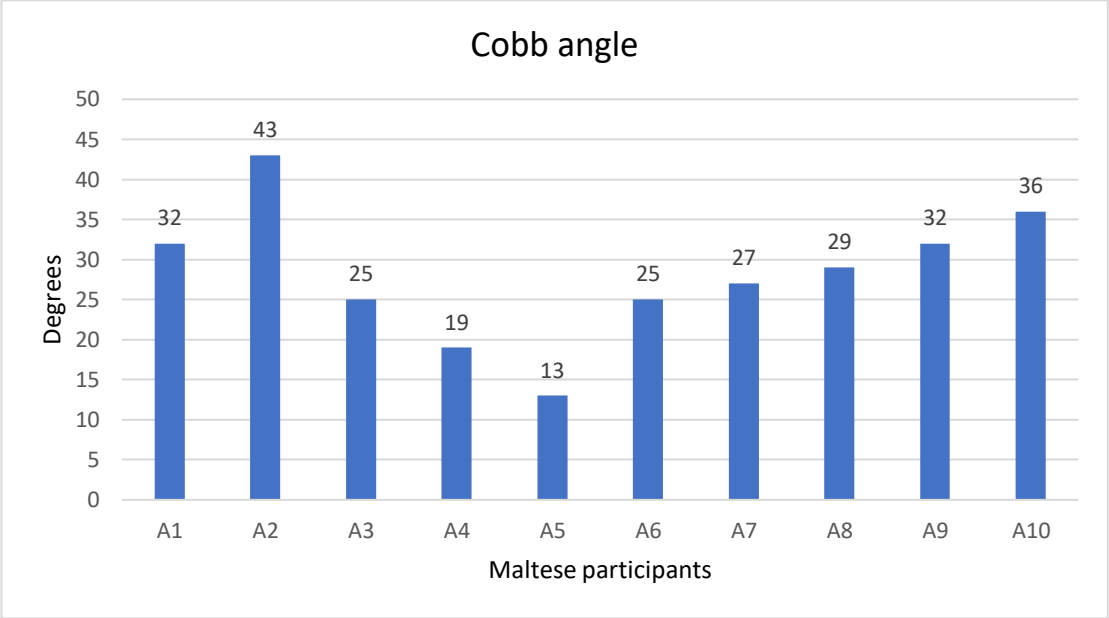
BMI



Graph 4.4 - BMI of Maltese AIS participants

The BMI of the Maltese AIS participants ranged from 14.5 kg/m^2 to 21.7 kg/m^2. The mean average BMI was 18.38 kg/m^2.

Cobb angle



Graph 4.5 - Cobb angle of Maltese AIS participants

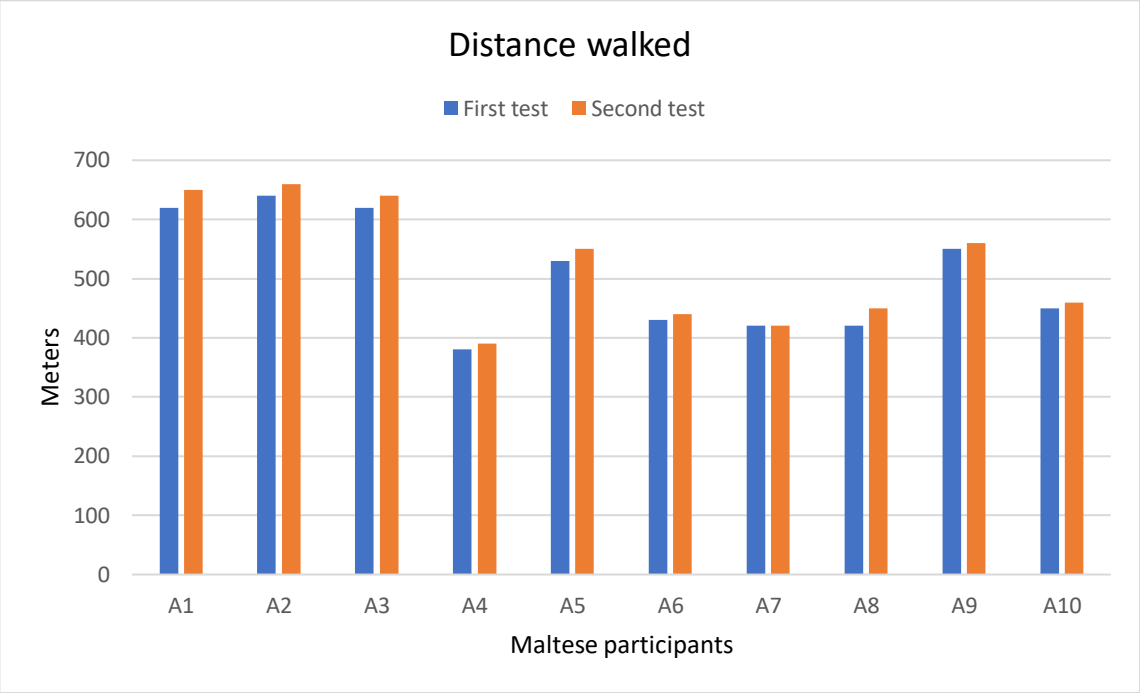
The Maltese AIS participants' Cobb angle ranged from 13° to 43°, with a mean average Cobb angle of 28.10°.

	n	Mean	Std. Deviation
Participants	10		
Age, yrs.	10	14.70	1.49
BMI, kg/m^2	10	18.38	2.04
Cobb angle, °	10	28.10	8.48
Height, m	10	1.60	0.07
Weight, kg	10	47.20	7.18

Table 4.1 - Antropometric measurements as a mean average and standard deviation for the total cohort of participants.

n = number of participants

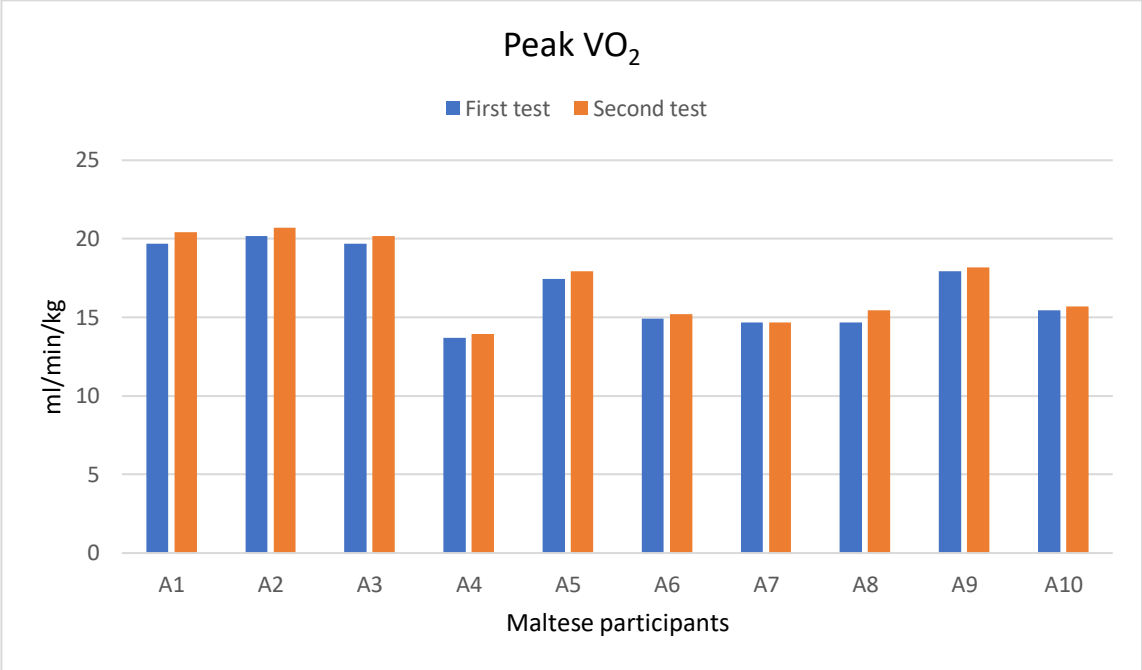
Distance walked



Graph 4.6 - Distance walked by Maltese AIS participants during the first and second test

The distance walked by the Maltese participants ranged from 380m to 640m during the first test, while for the second test, the distance walked ranged from 390m to 660m. The mean average distance walked for the first test was 506m, and the mean average distance walked for the second test was 522m.

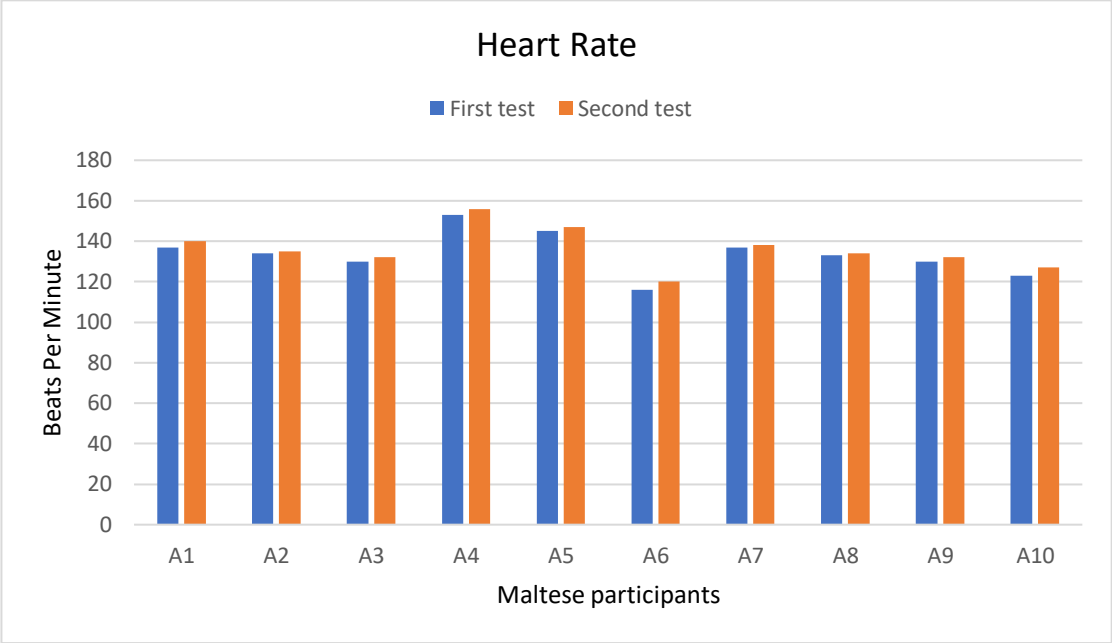
Peak VO_2



Graph 4.7 - Peak VO_2 of Maltese AIS participants during the first and second test

The Peak VO_2 ranged from 13.69 ml/min/kg to 20.19 ml/min/kg for the Maltese AIS participants during the first test, and during the second test, it ranged from 13.94 ml/min/kg to 20.69 ml/min/kg. The mean average Peak VO_2 was 16.84 ml/min/kg for the first test and 17.24 ml/min/kg for the second test.

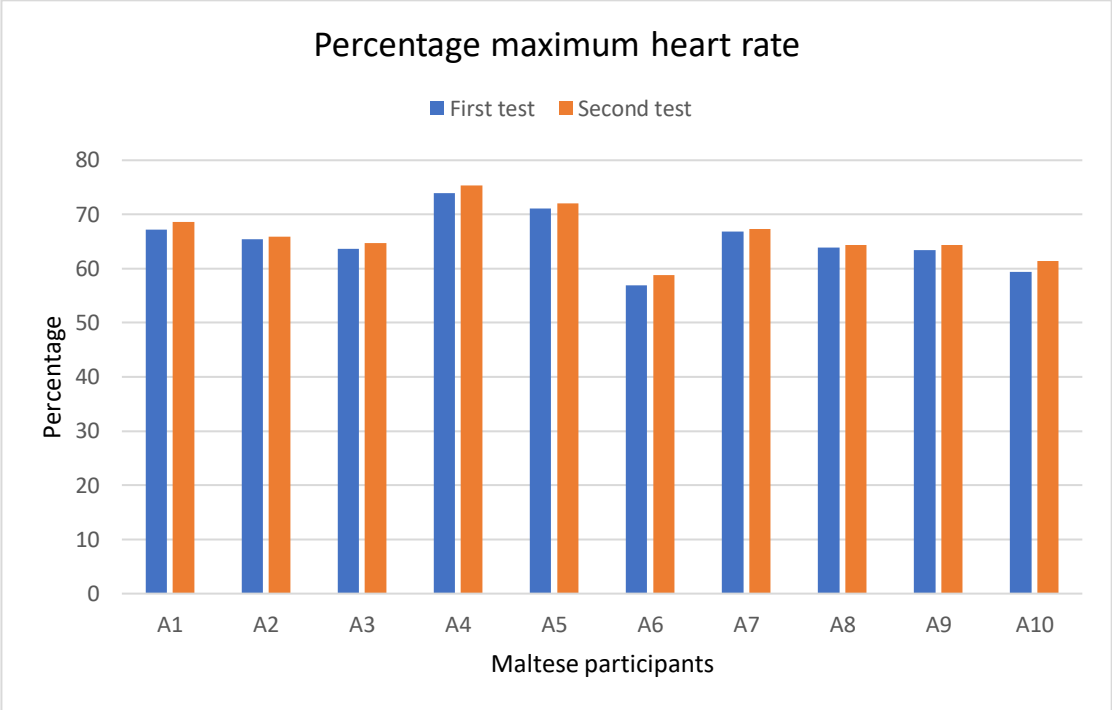
Heart rate



Graph 4.8 - Heart rate of Maltese AIS participants during the first and second test

The AIS participants' heart rate ranged from 116bpm to 153bpm during the first test and from 120bpm to 156bpm during the second test. The mean average heart rate for the first test was 133.8bpm and 136.1bpm for the second test.

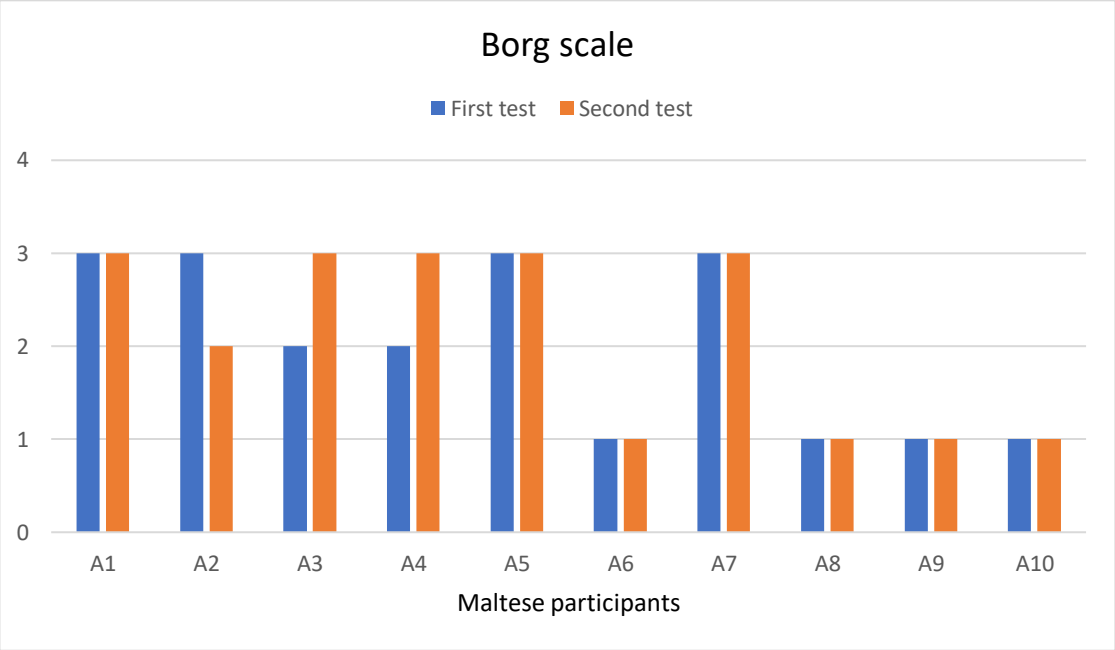
Percentage maximum heart rate



Graph 4.9 - Percentage maximum heart rate of Maltese AIS participants during the first and second test

The percentage maximum heart rate achieved of the Maltese AIS participants during the first test was 56.9% to 73.9% for the first test, and for the second test, it ranged from 58.8% to 75.3%. The mean average percentage heart rate for the first test was 65.17%, and for the second test, it was 66.29%.

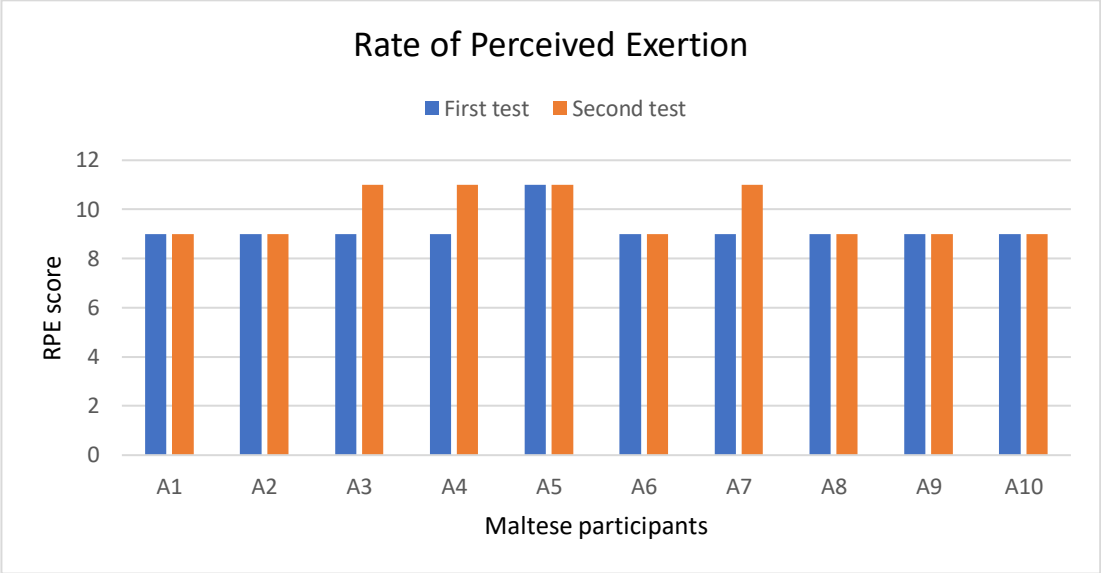
Borg scale



Graph 4.10 - Borg scale of Maltese AIS participants during the first and second test

Borg scale scores for the Maltese AIS participants ranged from 1 to 3 for both the first and second test, while the mean average borg scale for the first test was 2, and for the second test, it was 2.1.

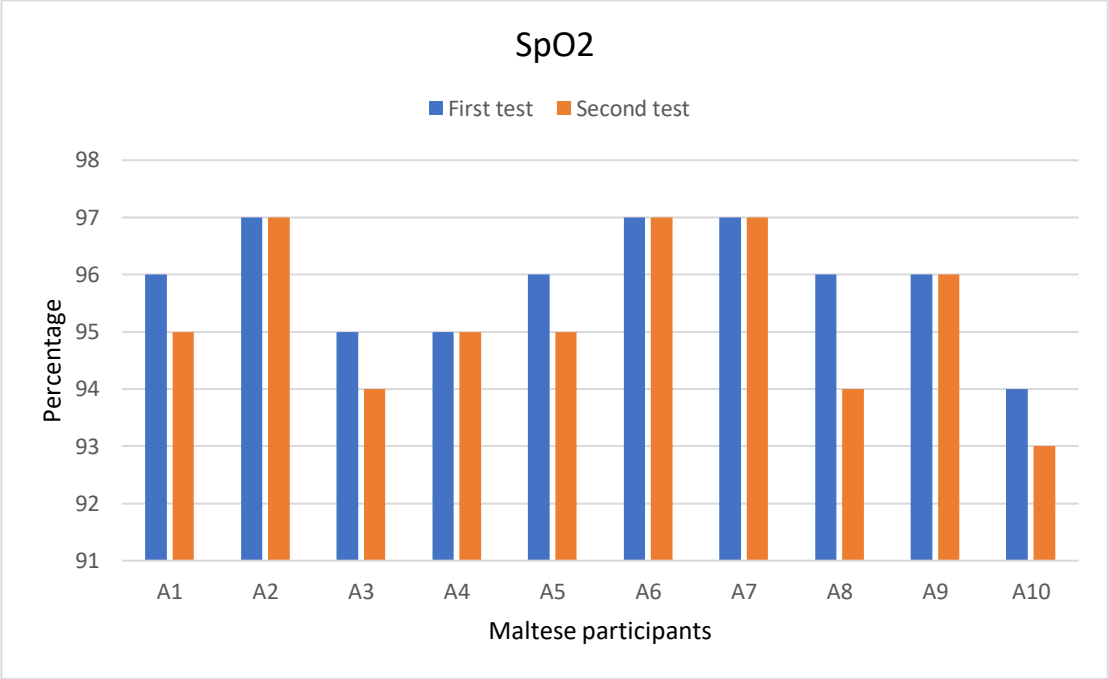
RPE



Graph 4.11 - Rate of perceived exertion of Maltese AIS participants during the first and second test

The RPE for the Maltese AIS participants ranged from 9 to 11 for the first and second test, with the mean average RPE for the first test was 9.2, and for the second test, it was 9.8.

SpO_2



Graph 4.12 - SpO_2 of Maltese AIS participants during the first and second test

SpO_2 readings for the Maltese AIS participants ranged from 94% to 97% for the first test and 93% to 97% for the second test. The mean average SpO_2 for the first test was 95.9%, and it decreased to 95.3% for the second test.

4.2 Summary

The results have shown a better performance during the second test as the participants managed to walk a longer distance and record higher levels of peak VO_2, heart rate, borg scale and RPE. The results will be discussed in the next section.

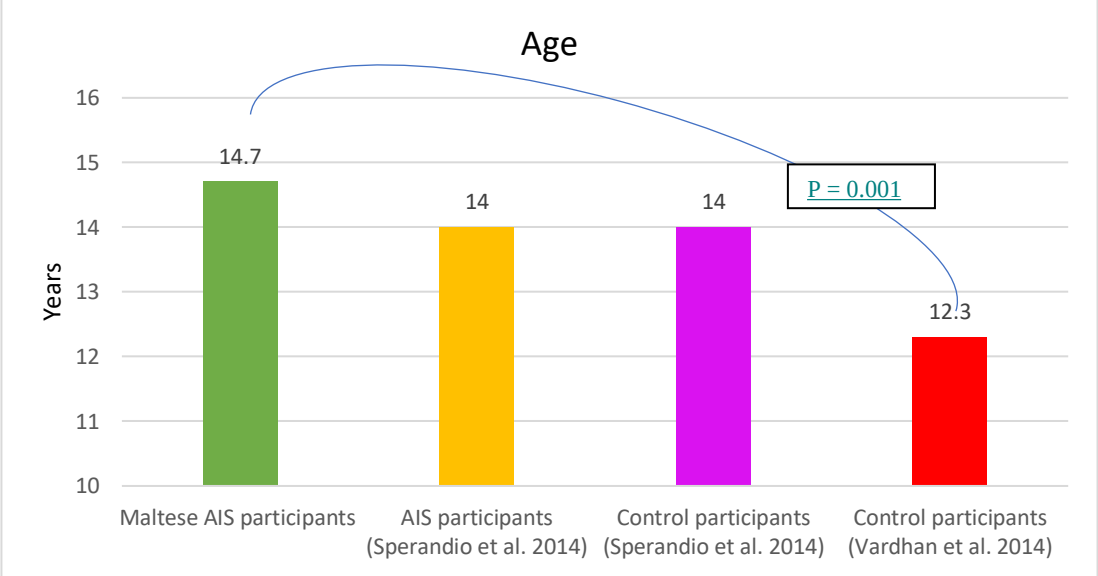
4.3 Discussion

Throughout this chapter, an analysis of exercise tolerance levels in a group of adolescents diagnosed with idiopathic scoliosis shall be provided. The results obtained through this study have also been compared with the results of two other studies by Sperandio *et al.* (2014) & Vardhan *et al.* (2017). A comparison was made with the results of girls only; the results of both genders and boys' results were excluded, as this study has only female participants. The results compared to the AIS participants of Sperandio *et al.* (2014) were age, height, weight, BMI, Cobb angle, distance walked, Peak VO_2, heart rate, percentage maximum heart rate achieved and Borg scale, during the 2nd test. The results compared to the control group of Sperandio *et al.* (2014) were age, height, weight, BMI, distance walked, Peak VO_2, heart rate, percentage maximum heart rate achieved and Borg scale during the 2nd test, while the results of the control group of Vardhan *et al.* (2017), were age, BMI and distance walked during the 1st test.

This comparison was carried out so as to observe the results of other AIS participants to local adolescents and compare with controls, being participants who do not have idiopathic scoliosis. Age, height and weight were matched with the study of Sperandio *et al.* (2014) as there was no statistically significant difference when the Maltese participants were compared with both the experimental and control groups as indicated below.

The mean age of the Maltese participants was 14.7 yrs (± 1.49), while the mean average age of the scoliosis participants and the control group of Sperandio *et al.*

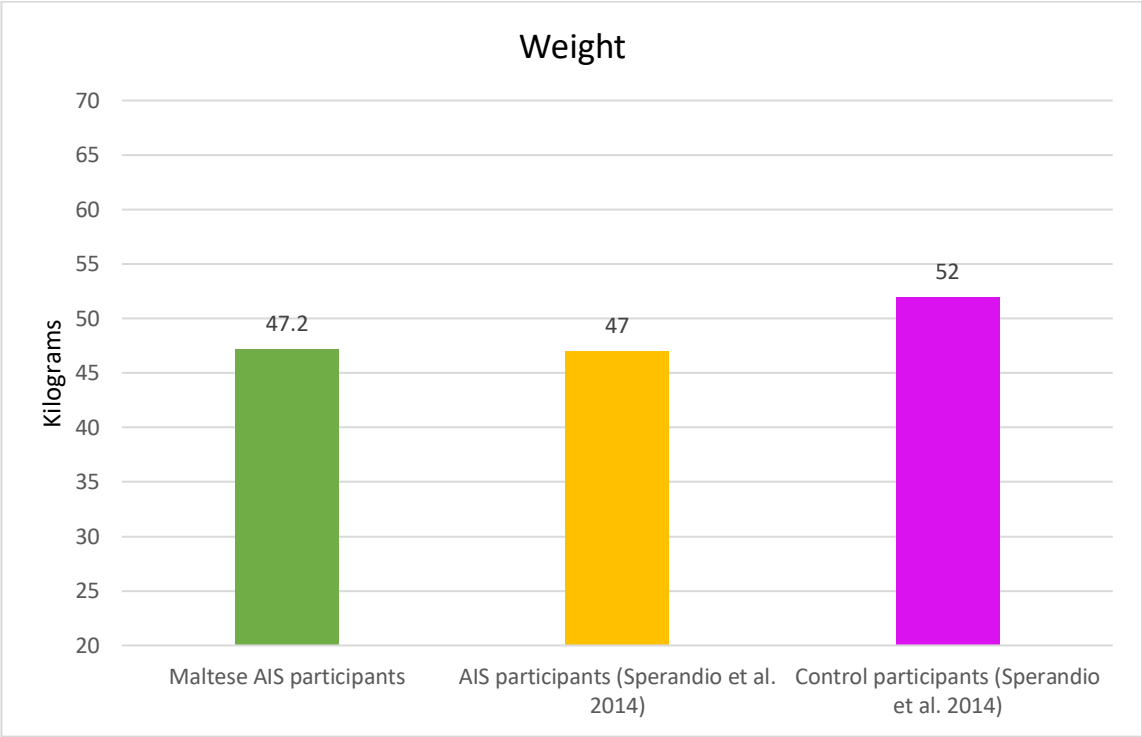
(2014) were both 14 yrs (± 2), which was t(9) = 1.481, *p* = .173. The average age of the participants of Vardhan *et al.* (2017) was 12.3 yrs (± 1.41); this was significantly lower than the Maltese cohort since there was a 2-year difference t(9) = 5.078, *p* = .001.



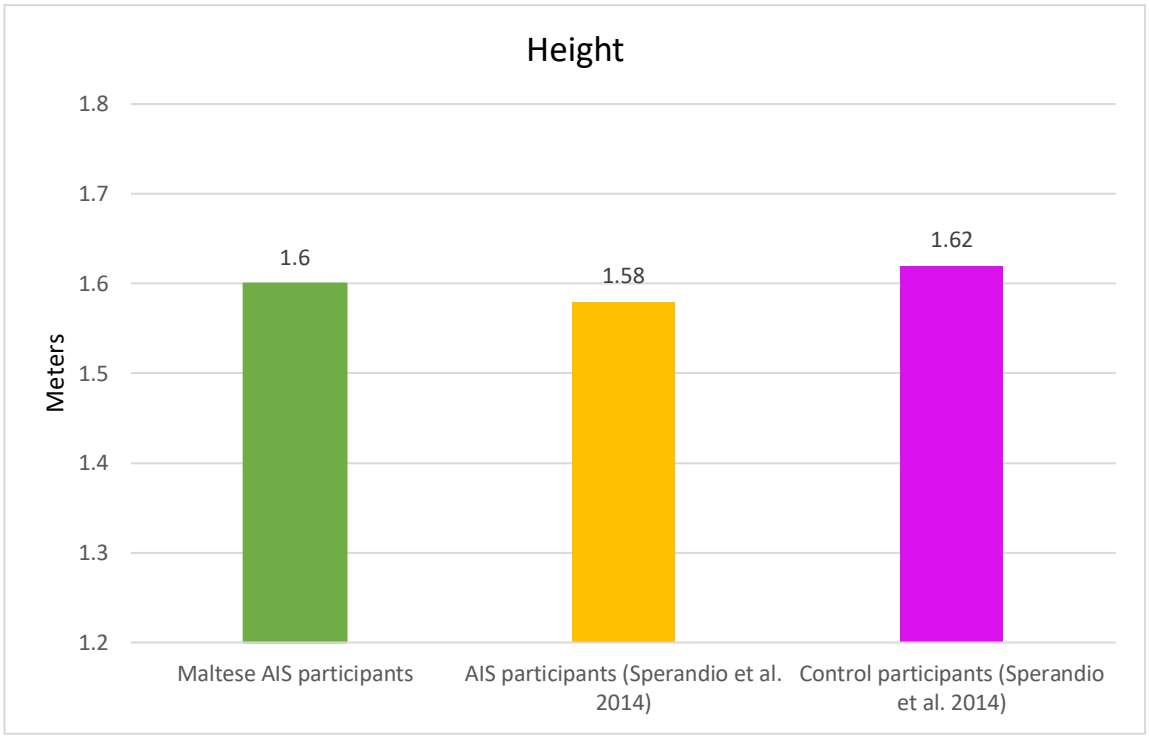
Graph 4.13 – Age of Maltese AIS participants, the AIS group from the study by Sperandio *et al.* (2014) and their control group and the control group from the study of Vardhan *et al.* (2017).

The average mean height for the local cohort of patients was 1.6m (± 0.07), and those in the study carried out by Sperandio *et al.* (2014) was 1.59m (± 0.1); t(9) = .488, *p* = .637. Mean weight was 47.2kg (± 7.18) for the Maltese participants and 47kg (± 10) for the participants of Sperandio *et al.* (2014) t(9) = .837, *p* = .040. The mean values for height and weight of the control group of Sperandio *et al.* (2014) were similar to the local cohort, with the weight of Maltese AIS participants being 47.2 kg and height 1.60m, while for the control group, the mean average height was 1.62m t (9) = -.976, *p* = .355 and mean average weight was 52kg t (9) = -2.115.

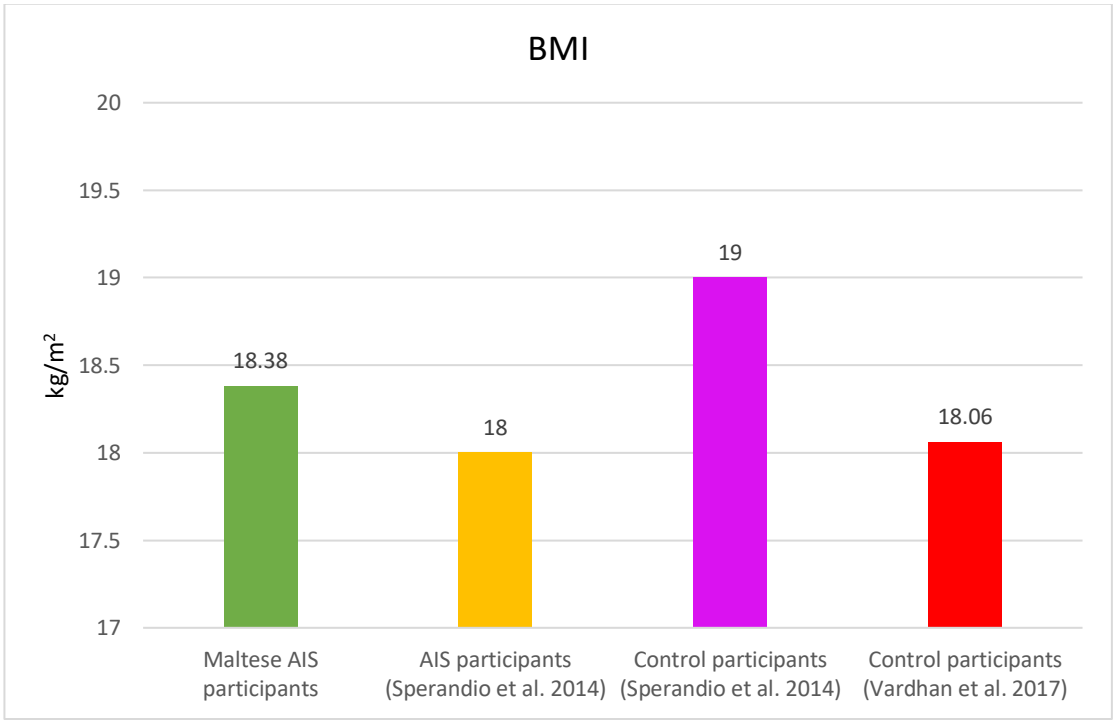
The mean BMI for the local participants was 18.38 kg/m^2 (± 2.04), while that of the AIS participants of Sperandio *et al.* (2014) was 18 kg/m^2 (± 2) t (9) = -.963, p = .361. The control group in the study by Sperandio *et al.* (2014) reported a mean average BMI of 19 kg/m^2 (± 2) t (9) = 590, p = 570. In the study of Vardhan *et al.* (2017), the reported average BMI was 18.06 kg/m^2 (± 3.27), resulting in no statistical significance t(9) = .497, p = 631. Having the participants matched in height and weight as well as BMI, as can be noted from the previous comparison of data using the one-sample t-test, increases the validity of the results.



Graph 4.14 - Weight of Maltese AIS participants and those from the studies of Sperandio *et al.* (2014) AIS group and control group.

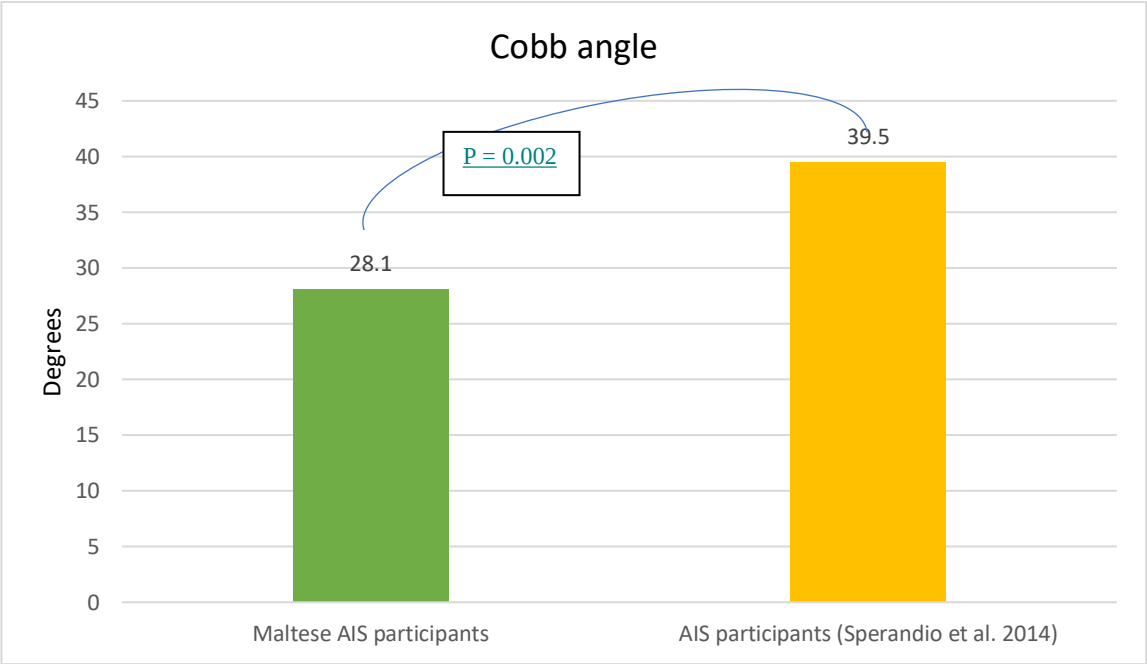


Graph 4.15 - Height of Maltese participants together with those from the study of Sperandio *et al.* (2014) for both the AIS group and control group



Graph 4.16 - BMI of Maltese AIS participants and participants from the study of Sperandio *et al.* (2014) for both the AIS group and control group and the control group of Vardhan *et al.* (2017)

The mean measure for the Cobb angle of Maltese participants was 28.10° (± 8.48) while the Cobb angle of Sperandio *et al.* (2014) was significant higher t(9) = -4.252, *p* = .002, having a mean average angle of 39.5° (± 17.4)

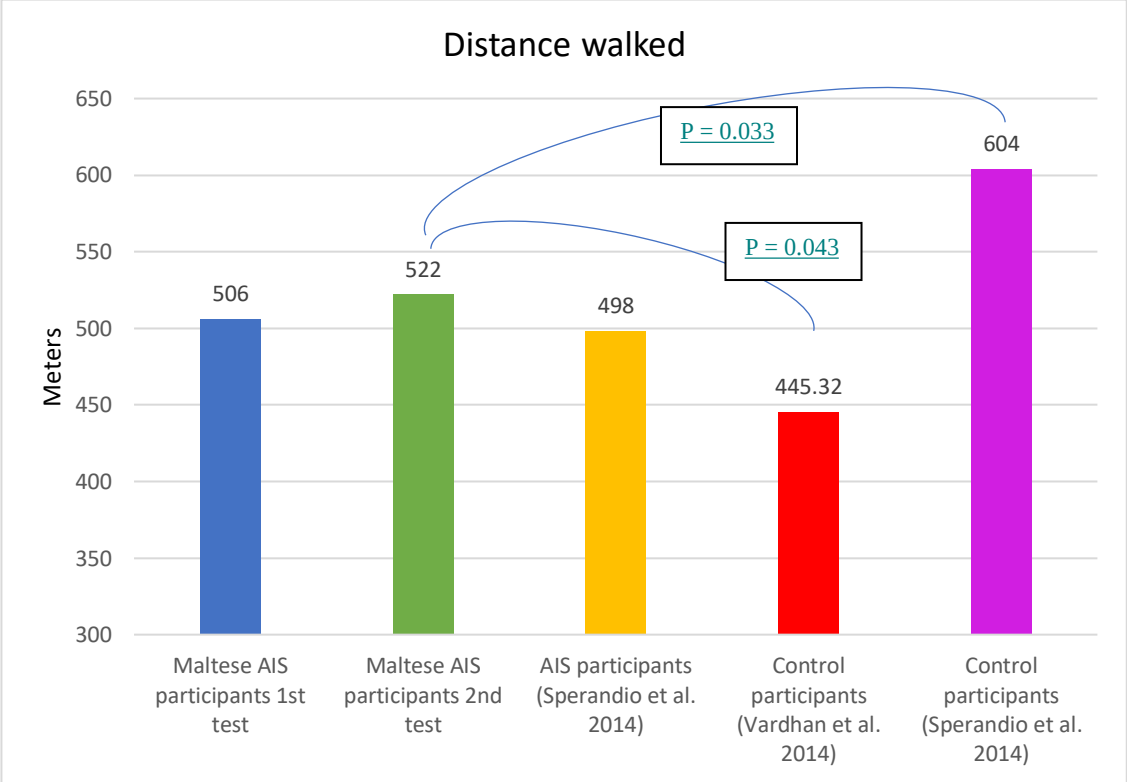


Graph 4.17 - Cobb angle of Maltese AIS participants and Sperandio *et al.* (2014) AIS group

4.4 Exercise Tolerance Measurements

From the ISWT of the 10 participants, data provided in Table 4.2, a total mean average distance reached during the first trial was 506m (± 97.78) and on the second attempt, this improved by 16m reaching a total mean average distance of 522m (± 102.83). Comparing these results to the other studies, the AIS participants of Sperandio *et al.* (2014) obtained a total average distance of 498m (± 144) and resulted in no statistical difference t(9) = .738, *p* = .479. The control group of

Sperandio *et al.* (2014) managed a distance of 604m (± 85), which was statistically significant higher than that of Maltese participants as they managed to walk a further 82m t (9) = -2.522, p = .033. Lastly, the participants of Vardhan *et al.* (2017) managed to walk 445.32m (± 85.59), a result that is statistically significantly lower than the result of local cohort t (9) = 2.358, p = .043.



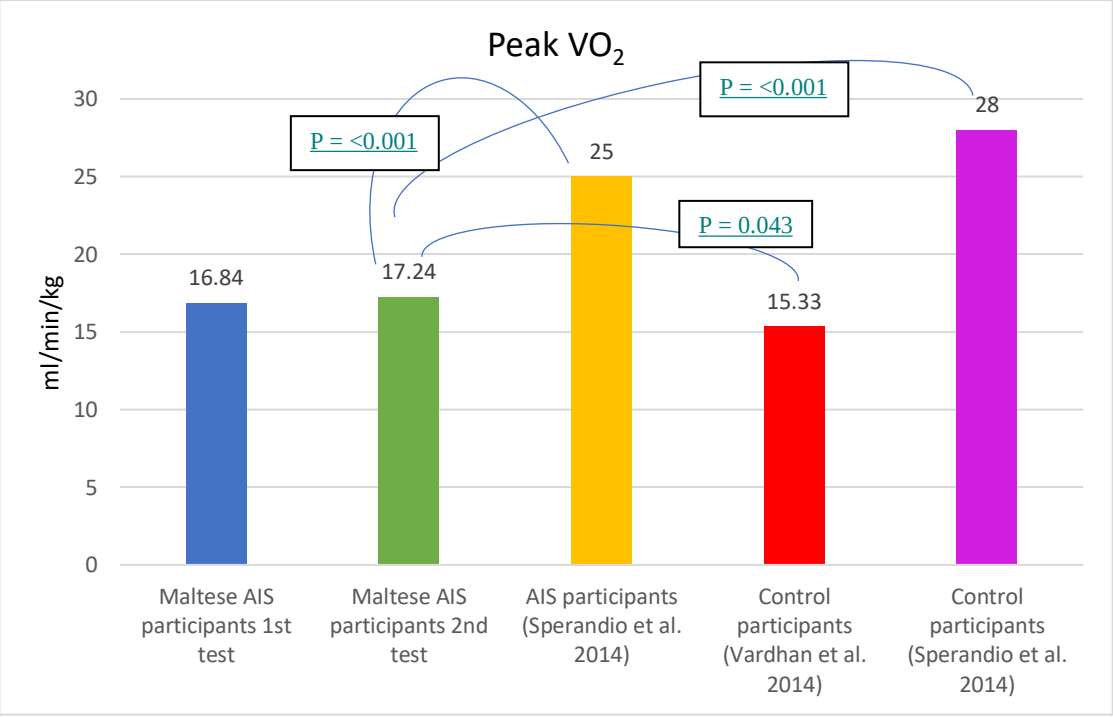
Graph 4.18 – Mean average distance walked by Maltese AIS participants, the AIS group from the study by Sperandio *et al.* (2014) and their control group during the 2nd test and the control group from the study of Vardhan *et al.* (2017).

4.5 Peak VO_2

The ten subjects of this study reached a total mean Peak VO_2 value of 16.84 ml/min/kg (± 2.44) during the first trial and increased this measure by 2.4% during the second trial to 17.24 ml/min/kg (± 2.57), a finding which corresponds to the increase in the distance covered during the shuttle walk test as reported above.

These results were lower than that obtained by the experimental group of Sperandio *et al.* (2014), as they demonstrated a mean average Peak VO_2 of 25 ml/min/kg (21-27), which statistical significance is higher than the Maltese participants t(9) = -9.546, p = <.001.

There was also a statistically significantly higher value for the control group of Sperandio *et al.* (2014) t (9) = -13.236, p = <.001, as they had a 62% increase in peak VO_2 reaching a mean average value of 28 ml/min/kg (24-33) which corresponds with the higher distance walked. Contrastingly, the participants of Vardhan *et al.* (2017) only managed a mean average of 15.33 ml/min/kg (± 2.13), which is statistically lower than that of the local participants t (9) = 2.350, p = .043.



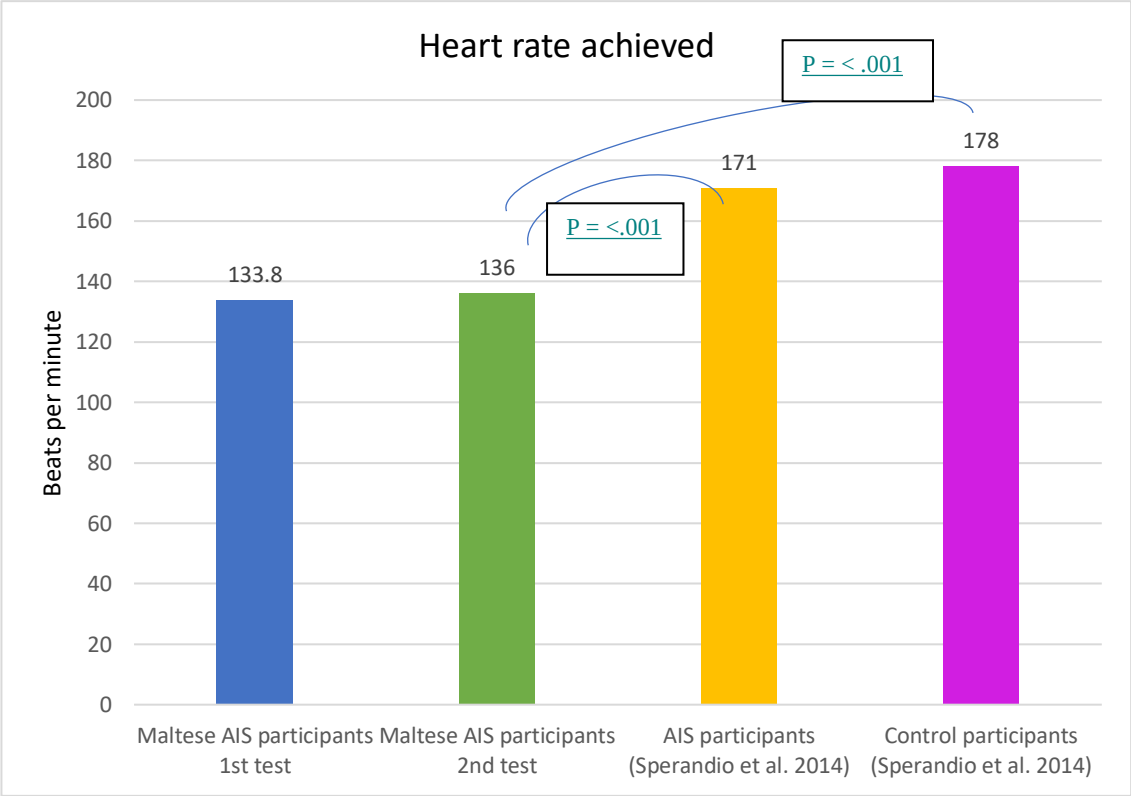
Graph 4.19 – Mean average peak VO_2 achieved by Maltese participants, the AIS and control group of Sperandio *et al.* (2014) during the 2nd test and the control group of Vardhan *et al.* (2017).

4.6 Heart rate on exertion

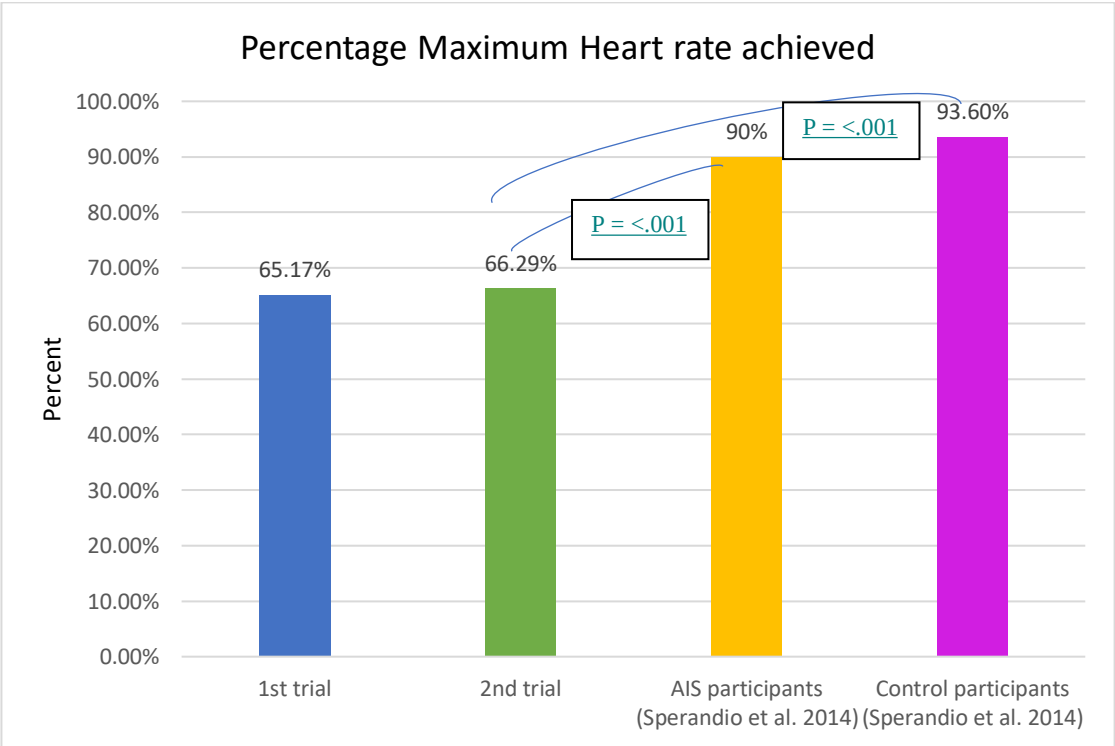
Maltese participants reported higher values in all measures; distance covered, Peak VO_2, heart rate on exertion, borg scale, and RPE, during the 2nd attempt, following the familiarisation test, which allowed the participants to become accustomed to what was required from them. At rest, the initial total average reading for the heart rate was that of 81.80bpm (± 10.56) and 82.70bpm (± 11.36) in the second test, following exertion from the ISWT, the mean average values were 133.8bpm (±10.42) during the first trial & 136.1 bpm (± 10.08) for the second trial. The percentage maximum heart rate achieved by these participants was 65.17% (± 5.02) during the first trial and 66.29% (± 4.84) for the second test.

The participants in the control group from the study conducted by Sperandio *et al.* (2014) registered a mean heart rate on exertion of 178bpm (± 18), 42 bpm more than the Maltese group, a value whose statistical significance is higher than the Maltese cohort t (9) = -13.142, p = <.001, while the experimental group mean average was 171bpm (± 21), also statistically significantly higher for the participants of Sperandio *et al.* (2014) t(9) = -10.946, p = <.001.

The percentage maximum heart rate achieved by the participants of Sperandio *et al.* (2014) was 93% for the control group t(9) = 243.979, p = <.001 and 90% for the experimental group t(9) = 236.361, p = <.001, showing that the participants of Sperandio *et al.* (2014) managed to achieve more than 90% of their maximum heart rate.



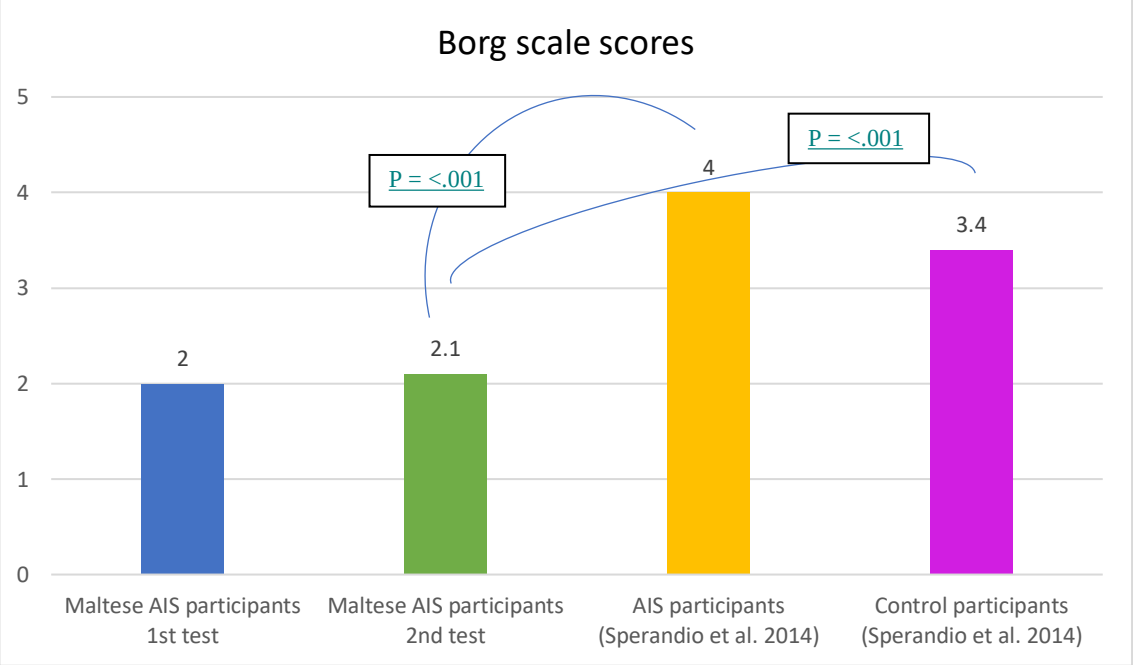
Graph 4.20 – Mean average heart rate achieved by Maltese AIS participants, the AIS group and the control group of Sperandio *et al.* (2014) during the 2nd test.



Graph 4.21 - Percentage maximum heart rate achieved by Maltese participants, the AIS group and the control group Sperandio *et al.* (2014) during the 2nd test.

4.7 Borg scale and Rate of Perceived Exertion

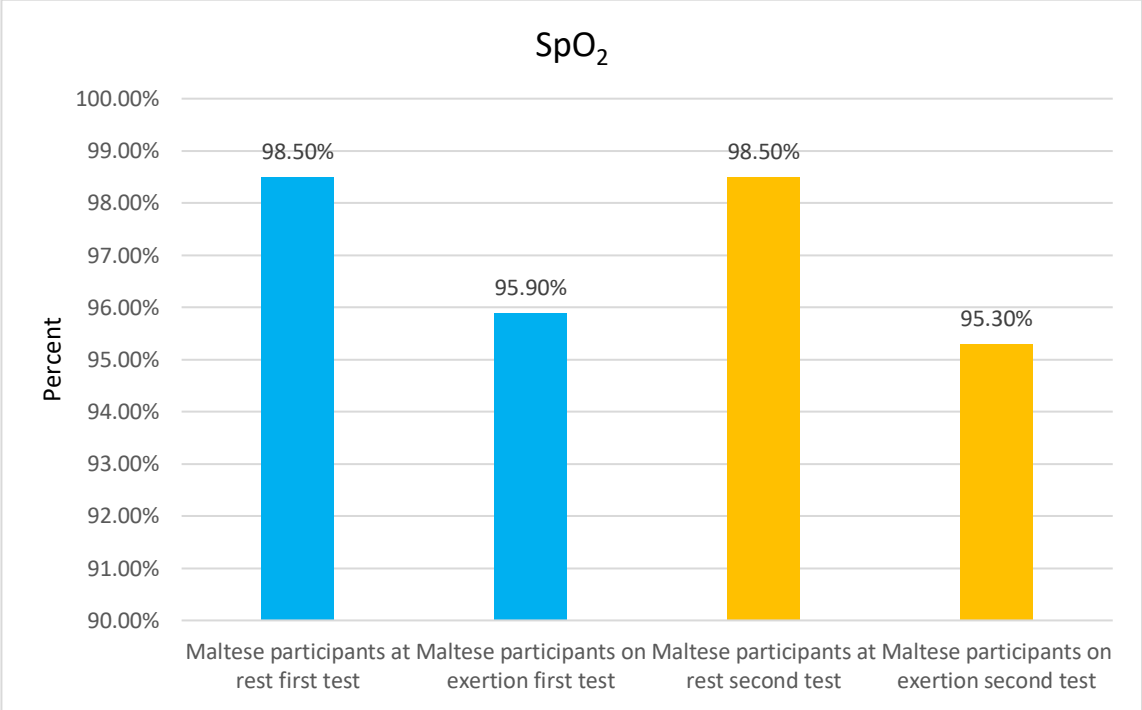
The 2nd test of the Maltese participants demonstrated slightly higher Borg scale scores on exertion 2.10 (± 1.0) and RPE scores 9.80 (± 1.03) than the first; 2.00 (± 0.94) for the former and 9.20 (± 0.63) for the latter, results which correspond the increase in performance, carried out by the Maltese participants. Nevertheless, the increase in borg scale score during the second test was still lower than the scores obtained by the participants from the study of Sperandio *et al.* (2014) as the control group reported a borg scale reading of 3.40 (± 1.8), resulting in a higher statistical difference t(9) = - 6.042, *p* = <.001 and 4.00 (± 2.8) for AIS participants, deriving a higher significant difference t (9) = -4.134, *p* = .003. The resting Borg scale for the first and second test resulted in no ratings of dyspnoea as measured using both the Borg scale 0 (± <.001) and RPE 6 (± <.001).



Graph 4.22 - Mean average borg scale scores by Maltese AIS participants, in comparison with the AIS group and the control group of Sperandio *et al.* (2014) during the 2nd test.

4.8 SpO_2

The mean average SpO_2 readings at rest were both 98.50% (± 0.53) for both tests, while on exertion, the saturation levels of oxygen decreased slightly, resulting in a mean average SpO_2 of 95.90% (± 0.99) during the first test and 95.30% (± 1.4) during the second test.



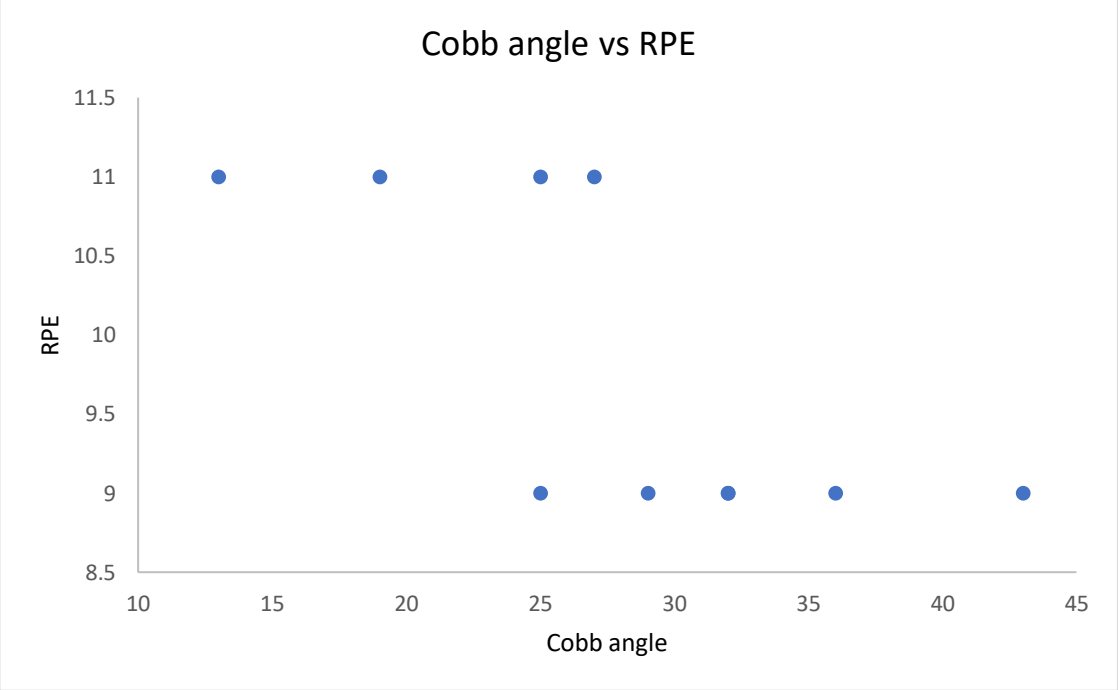
Graph 4.23 - Mean average SpO_2 reading of Maltese participants pre and post the first and second tests.

	N	Mean	Std. deviation
Participants	10		
Distance walked (m) – 1st test	10	506	97.78
Distance walked (m) – 2nd test	10	522	102.83
Peak VO_2 (ml/min/kg) - 1st test	10	16.84	2.44
Peak VO_2 (ml/min/kg) - 2nd test	10	17.24	2.57
Heart rate at rest (bmp) - 1st test	10	81.80	10.56
Heart rate at rest (bmp) - 2nd test	10	82.70	11.36
Heart rate on exertion (bmp) - 1st test	10	133.80	10.42
Heart rate on exertion (bmp) - 2nd test	10	136.10	10.08
Percentage maximum heart rate - 1st test	10	65.17	5.02
Percentage maximum heart rate - 2nd test	10	66.29	4.84
Borg scale score on exertion - 1st test	10	2.00	0.94
Borg scale score on exertion - 2nd test	10	2.10	0.99
RPE on exertion - 1st test	10	9.20	0.63
RPE on exertion - 2nd test	10	9.80	1.03
SpO_2 at rest (%) - 1st test	10	98.50	0.53
SpO_2 at rest (%) - 2nd test	10	98.50	0.53
SpO_2 on exertion (%) - 1st test	10	95.90	0.99
SpO_2 on exertion (%) - 2nd test	10	95.30	1.42

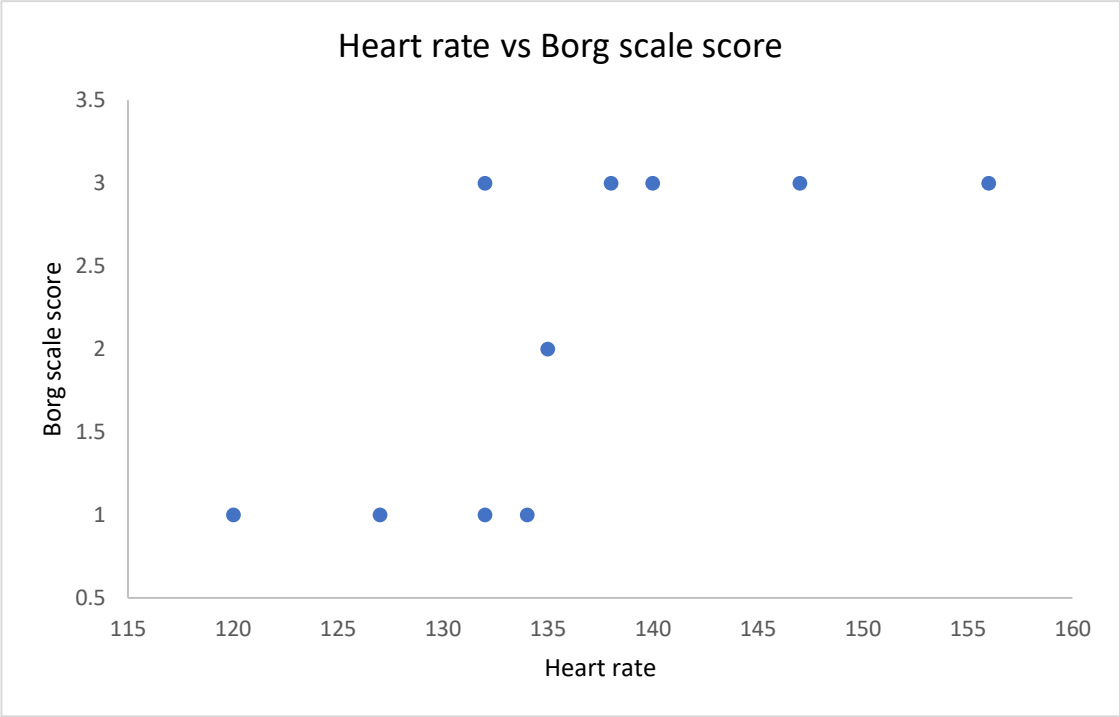
Table 4.2 – Results of the ISWT for the 1st and 2nd test

4.9 Correlations

Correlations were also computed using the Pearson rank of correlation so as to find the relationship between some of the variables. A correlation was shown between Cobb angle and RPE on exertion (r = -.721, n = 10, *p* = .019), which shows that as the Cobb angle increased, the RPE score on exertion decreased from 11 to 9. In turn RPE on exertion correlated with Borg scale on exertion (r = .779, n = 10, *p* = .008), showing that as the Borg scale scores increased so did the RPE scores. Borg scale scores and heart rate on exertion shared a correlation (r = .708, n = 10, *p* = .022) where the Borg scale scores increased as the heart rate increased.



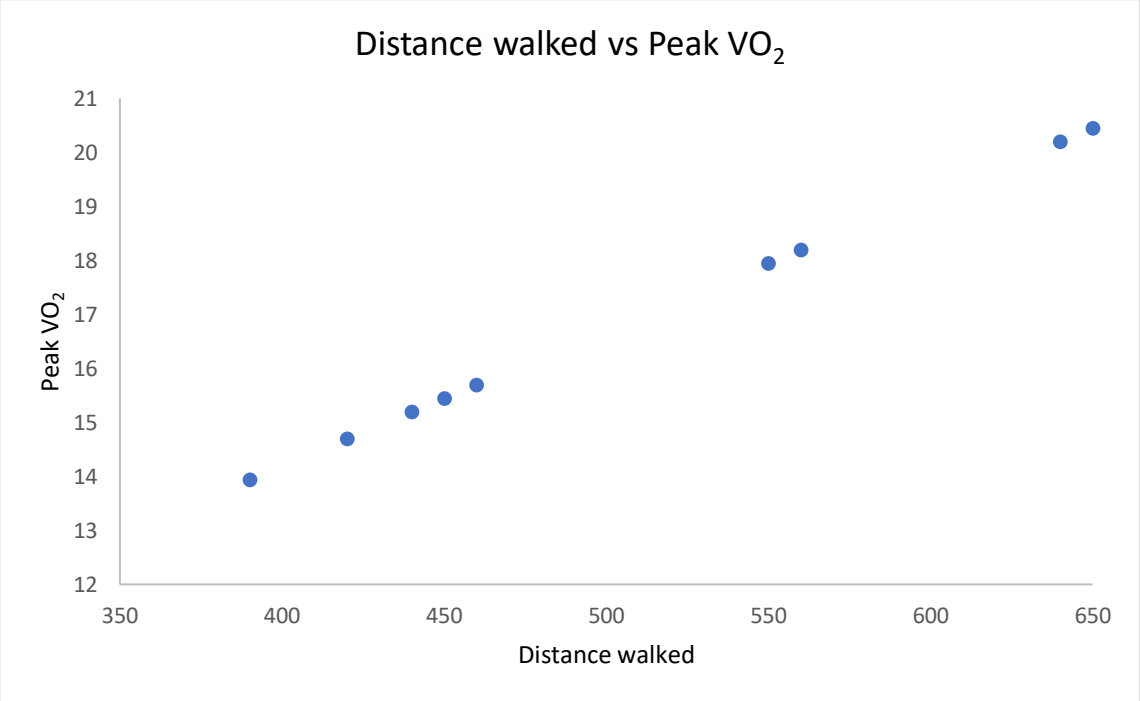
Graph 4.24 - Correlation between Cobb angle and RPE



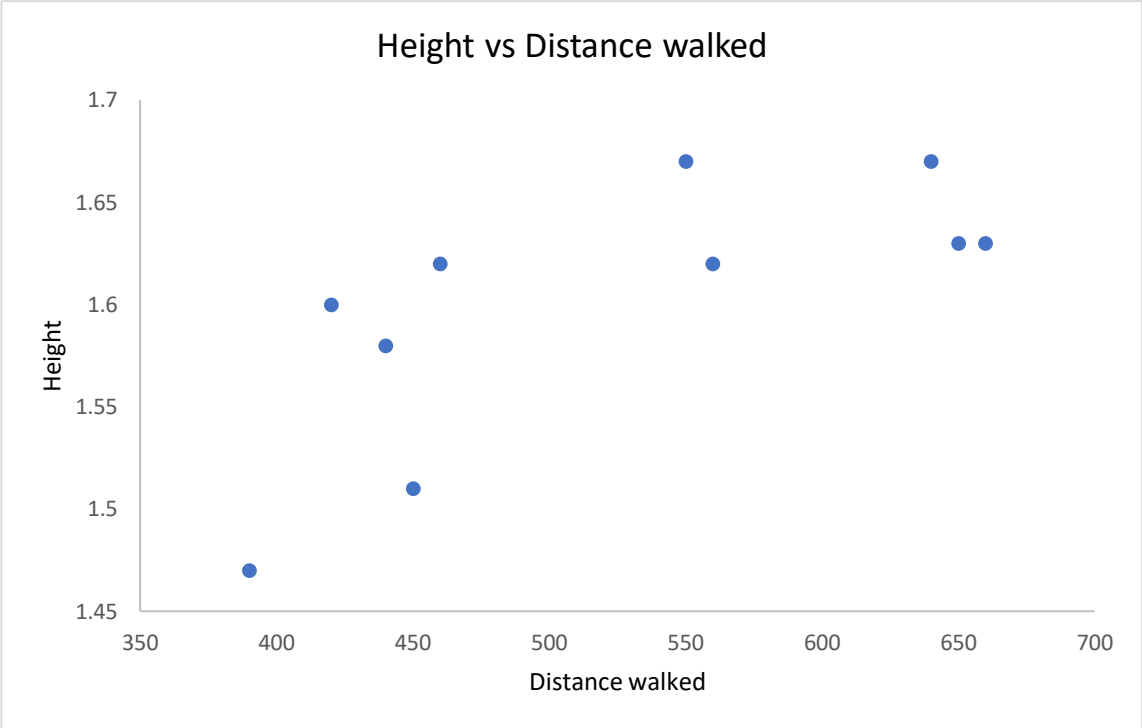
Graph 4.25 - Correlation between heart rate and Borg scale score

Distance walked highly correlated with Peak VO_2 (r = 1.000, n = 10, *p* = .000), showing that the increased distance walked resulted in a higher peak VO_2.

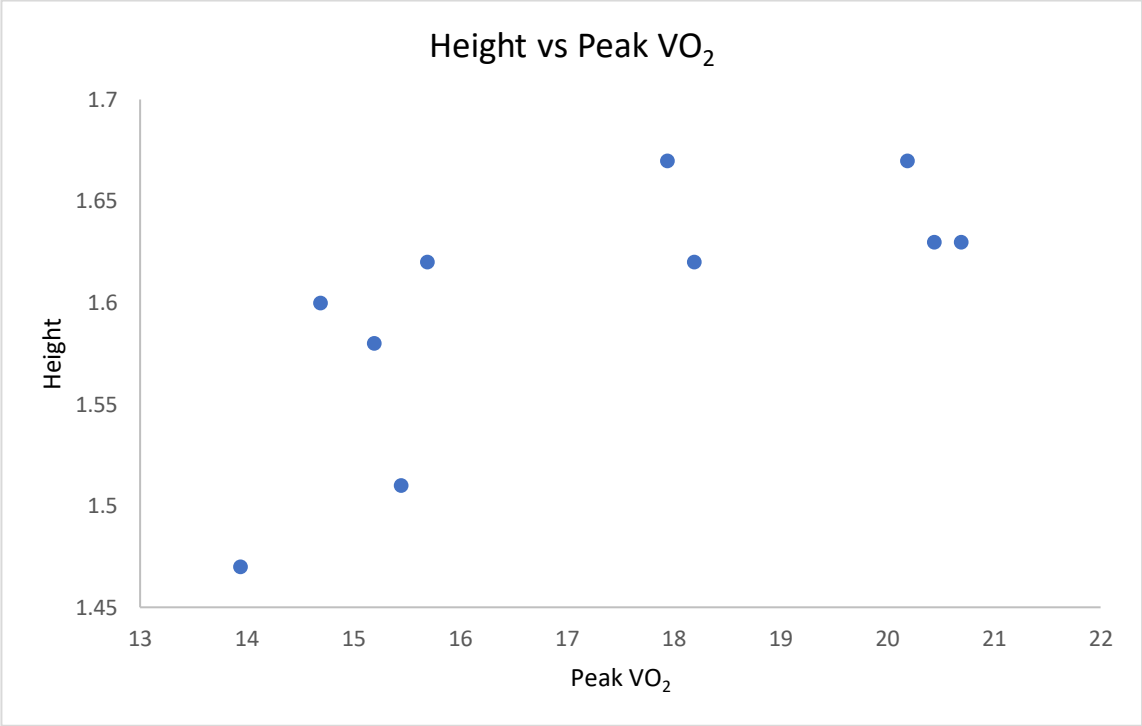
Height had a correlation with both distance walked (r = .717, n = 10, *p* = .020) and Peak VO_2 (r = .717, n = 10, *p* = .020) where it demonstarted that taller participants managed to walk a longer distance and also resulted in a higher peak VO_2 than shorter participants.



Graph 4.26 - Correlation between distance walked and Peak VO_2

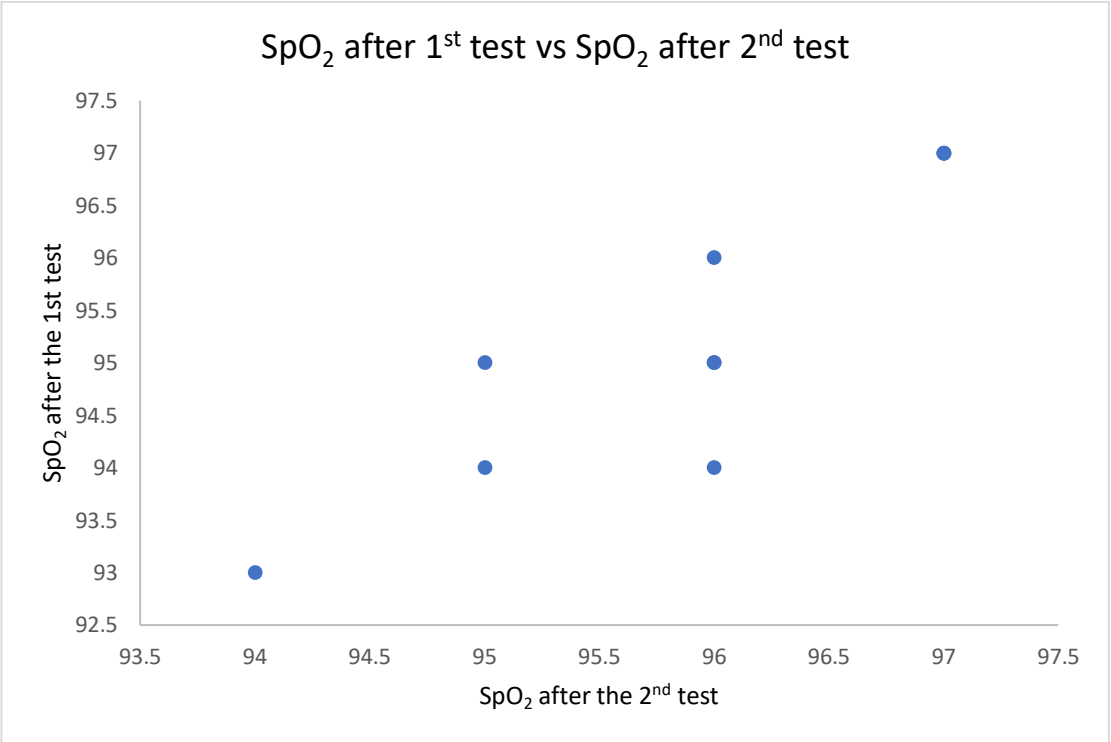


Graph 4.27 - Correlation between height and distance walked



Graph 4.28 - Correlation between height and Peak VO_2

Lastly, SpO_2 after the first test correlated with SpO_2 after the 2nd test (r = .890, n = 10, *p* = .001), where it showed that during both tests, the participants had a similar decrease in oxygen saturation.



Graph 4.29 - Correlation between SpO2 after 1st test and SpO2 after 2nd test

4.10 Overview

This study evaluated the exercise tolerance of a small sample of adolescent idiopathic scoliosis participants. So far, few studies have been conducted assessing the exercise tolerance of adolescents with idiopathic scoliosis. Nevertheless, the ISWT was initially developed to assess adult patients older than 40 years of age. Participants in this study showed decreased ISWD and Peak VO_2 compared to the control group of Sperandio *et al.* (2014). Decreased exercise tolerance in AIS was typical in numerous studies.

4.11 Exercise tolerance

Nonetheless, Saraiva *et al.* (2018) observed that scoliosis participants could not reach higher levels of the ISWT as they had to stop because they were unable to reach the mark before the audio beep. Decreased functional capacity was also noted in the study of Dos Santos Alves and Avanzi, (2009), as they reported a decrease in 6-minute walk distance in patients with AIS compared to a control group, showing that AIS patients were unable to finish the test. This study also noted that all the Maltese participants had to stop as the audio beeped before reaching the target. Therefore this may show that the ISWT may be unattainable to finish.

The results of distance walked, and peak VO_2 of the Maltese cohort were higher than those of the control group of Vardhan *et al.* (2017). One possibility for the decreased distance walked may be that the mean average age of Vardhan *et al.* (2017) was two years younger than that of the Maltese cohort. This means that the majority of the participants may have been shorter than the Maltese group. In fact, Vardhan *et al.* (2017) emphasized in their study that as the participants' height increased, so did the distance walked by the participants. Another possibility was that the participants performed one ISWT. If the participants performed a second test, then the participants would have elimanted the learning effect and might have demonstarted better results. In addition to this, the study of Vardhan *et al.* (2017) consisted of a larger sample size (180), much larger than the Maltese sample size (10). However, in comparison with the countries population, the Maltese sample size results in a higher number, since India has a much larger population size

compared to Malta. This may show that both results do not represent the whole population.

Maltese participants reported lower values of Peak VO_2, this is in keeping up with other studies by Leech *et al.* (1985); Barrios *et al.* (2005); Czaprowski *et al.* (2012); Sperandio *et al.* (2015); Saraiva *et al.* (2018) which also reported decreased $VO_{2\ max}$. The study of Saraiva *et al.* (2018), reported poor pulmonary function and decreased walking distance by the AIS group. They state that since the AIS group walked a shorter distance, they present inadequate physiological responses. Also, the AIS group showed lower values of $VO_{2\ max}$ compared to the control group, and they continue to say that as the Cobb angle increases, both the $VO_{2\ max}$ and distance walked decreases. Saraiva *et al.* (2018) believe that physical deconditioning may be the primary contributor to the decrease in VO_2 and distance walked as it prevents the participants from reaching their maximum effort. Lower values of $VO_{2\ max}$ were also reported by Leech *et al.* (1985); Barrios *et al.* (2005); Czaprowski *et al.* (2012); Sperandio *et al.* (2015).

Sperandio *et al.* (2015) found a correlation between the chest wall shape and Peak VO_2. This correlation may indicate ventilatory inefficiency and may represent AIS patients' lower physical ability due to the scoliotic curve.

4.12 Causes

Kesten *et al.* (1991) suggested the lower exercise tolerance found in their study may be attributed to decreased aerobic exercise. In this study, the Maltese participants' lower exercise tolerance cannot be attributed to physical inactivity as some of the participants were physically active and participated in different sports.

After completing an aerobic exercise, AIS participants were noted to walk a longer distance during the 6MWT (Alves, Stirbulov and Avanzi, 2006). A similar study by Athanasopoulos *et al.* (1999) found an improvement in aerobic capacity of about 48% of the participants following aerobic training. These results show that physical activity may have a pivotal effect on increasing the exercise tolerance of AIS patients since it may not be due to body mechanics but rather decreased aerobic training.

Some researchers stated that AIS participants had decreased muscle strength; however, muscle strength was not measured in this study; Martínez-Llorens *et al.* (2010) found a decrease in quadriceps muscle strength which may contribute to the decreased distance walked. Respiratory muscle strength was noted to be lower (Barrios *et al.* 2005; Sperandio *et al.* 2014), which could also affect the decreased distance walked.

4.13 Comparing the ISWT and the 6MWT

Dos Santos Alves and Avanzi, (2009) reported a six-minute walk distance (6MWD) of 433.93m by AIS participants with a mean average heart rate of 109.26 bpm. The oxygen saturation decreased to 97.45% during the 6MWT. If these results had to be compared with the Maltese participants' results, then one would notice a higher distance walked by Maltese participants (522m). The heart rate was also higher for the Maltese participants (136 bpm), while the mean average oxygen saturation was 95.3%. This may indicate that the ISWT may elicit higher demands for completing the test as it is externally paced and requires the participant to keep up with progressive audio rather than adapting to a self-paced walk. This was supported by Saraiva *et al.* (2018), as their participants could not finish the test.

Furthermore, the results of the control group of Dos Santos Alves and Avanzi, (2009), aged between 10 and 18 years, showed a mean average distance walked of 589.65m, with a mean heart rate of 109.13bpm, while 99.35% was the mean for oxygen saturation during the test. These results show that although the distance walked was higher than the Maltese group (522m), the mean average heart rate was lower and oxygen saturation was higher during the 6MWT, which may also indicate that the self-paced nature of the 6MWT does not assess the participants' maximum functional capacity. This implies that maybe the ISWT is more indicated when maximal functional capacity is required to be examined.

The ISWT may be a tough test to complete, as when comparing heart rates of two studies, one where participants were asked to run on their own accord (Barrios *et*

al. 2005), compared to one where participants could only walk during the ISWT (Saraiva *et al.* 2018), the mean average heart rates were similar. Barrios *et al.* (2005) reported heart rate values of 184 bpm for the AIS group (21°) and 188 bpm for the control group, while the study by Saraiva *et al.* (2018) reported values of mean average heart rate for the AIS group >45° (162), AIS group <45° (175) and the control group (181). This shows that the ISWT may be too hard for some participants who are very physically unfit or fresh out of surgery.

4.14 Effects of Cobb angle severity

There seems to be varying opinions of Cobb angle severity on functional exercise tolerance. On the one hand Dos Santos Alves and Avanzi, (2009) stated that the decrease in functional capacity found during the 6MWT in AIS participants might be due to cardiovascular deconditioning. There was no correlation between the severity of the Cobb angle and the participants' functional exercise capacity. 86 participants were recruited for this study with a mean average age of 14.39 years, and Cobb angle ranging from 45° to 138°. Other studies did not correlate the Cobb angle with the decreased exercise tolerance, such as the study by Leech *et al.* (1985), who recruited 88 participants of both genders with a Cobb angle ranging from 3° to 46° and reported similar $VO_{2\ max}$ between the mild scoliotic participants (>46°) and their control group.

In this study, there was also no correlation between the severity of Cobb angle and exercise tolerance; however, as the sample size was small (10) and the Cobb angles

varied from 13° to 43°, the results may have been different with a larger population and a more extensive Cobb angle range.

This idea was argued by Saraiva *et al.* (2018), as they noted that patients with a Cobb angle of > 45° performed worse during the ISWT than those who have a Cobb angle <45°. In this study, no participants had a Cobb angle higher than 45°; Cobb angles of Maltese participants ranged from 13° to 43°, with no reported correlation between the severity of the Cobb angle and the distance walked. A larger population with a broader range of Cobb angles may have resulted in a different result and correlation. Saraiva *et al.* (2018) emphasized that the Cobb angle's severity significantly correlates proportionally with the ventilatory limitation.

In fact Borowitz, Armstrong and Cerny, (2001) state that as the spine rotates due to scoliosis, the chest wall may rotate and compress the main bronchi with the mediastinal structures or the vertebrae, resulting in a reduction of airflow. A difference between mild scoliosis (10°- 24°) and a moderate scoliosis group (24°-40°) was noted in the study of Czaprowski *et al.* (2012) as the moderate group reported lower values of $VO_{2\ max}$, which may have been affected more by the higher Cobb angle. Chong et al. (1981) attributed the decrease in exercise tolerance with a greater Cobb angle as the participants who had higher Cobb angles performed poorly compared to those who had lower Cobb angles.

The minimum clinically important difference (MCID) for adult patients aged 68 – 70 years suffering from COPD, was studied by Singh *et al.* (2008). The results show that

48m accounting for about five shuttles was a minimum clinically important difference between the two tests. Saraiva *et al.* (2018) mention that although the difference in distance walked between the AIS groups was lower than the MCID, it is still evident that AIS participants with severe Cobb angles may have lower exercise tolerance since they walked a shorter distance. Furthermore, to this day, there are no studies that studied the MCID value for adolescent populations.

4.15 Learning effect

Singh, (2007), Sperandio *et al.* (2015) and Saraiva *et al.* (2018) all emphasized the importance of a practice test before the proper test readings to eliminate the learning effect. Furthermore, Singh, (2007) found no difference between the second and third test, showing that the learning effect would have passed during the second test. Participants tend to perform better during the second test, and this was also noted in the Maltese participants as there was a significant difference between the first and second test. Mean average distance walked and Peak VO_2 were higher for the second test, with higher values of mean average heart rate and lower value of oxygen saturation during the second test.

Dyer *et al.* (2011) stated that 65% of the participants had a higher walking distance in the second test, and this was also noted in this study where all the Maltese participants managed to walk a longer distance during the second test. Performing a practice ISWT is vital to eliminate the learning effect and accurately measure the participants' exercise tolerance.

CHAPTER 5 - CONCLUSION

5.1 Brief description of the study and key findings

The results obtained from the ISWT have shown a trend in which the Maltese AIS patients have demonstrated a decrease in exercise tolerance when compared to controls in other studies. Since the sample size was small (n = 10), this decrease in exercise tolerance does not represent the whole population of AIS patients in Malta.

5.2 Main Research Limitations.

The main research limitation was the sample size (n = 10), compared to other studies with a larger sample size, (n = 180) (Vardhan *et al.* 2017). A larger sample size would have given a more accurate result of the whole Maltese AIS patients.

5.3 Strengths and Limitations of the study.

5.31 Strengths

The inclusion and exclusion criteria made it possible to target the desired population and eliminating any confounding variables. This study demonstrated lower performance by AIS female participants during the ISWT, and therefore, the hypothesis was met as the Maltese participants demonstrated decreased exercise tolerance compared to a control group.

5.32 Limitations

There were some limitations in this study; the primary limitation was the small sample size, which was further complicated by the pandemic as only the urgent

cases were attending the OOP department and MDH, and some patients refused to participate in the study. Another limitation is that a Maltese control group should have been recruited to compare the Maltese AIS participants with Maltese controls, rather than comparing them with other studies from abroad. Larger sample size would have enabled the participants to be divided into groups according to their Cobb angles and eventually show the differences between different Cobb angles. Lastly, pulmonary function testing would have been performed to assess the pulmonary function during the ISWT by examining the $VO_{2\ max}$ of the participants rather than calculating the Peak VO_2 which is the predicted measure. Also, the study would have a deeper examination of the patients' exercise tolerance.

5.4 Recommendations

5.41 Contribution to the Profession.

The results may give physiotherapists an indication regarding the exercise tolerance of the patients who have idiopathic scoliosis. One part of the holistic approach in treating scoliosis by physiotherapy would be to address exercise tolerance during sessions by prescribing walking or running routines.

5.42 Further research

Further research can be conducted on a larger population of Maltese AIS patients. Further research may give a clearer insight into possible factors affecting exercise tolerance. Also, performing an exercise programme as well as assessing post-surgical patients may demonstrate changes in exercise tolerance.

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Appendix 1 - Ethical approval

L-Università ta' Malta

Sebastian Zammit <sebastian.zammit.17@um.edu.mt>

UREC FORM V_15062020 5917 Sebastian Zammit

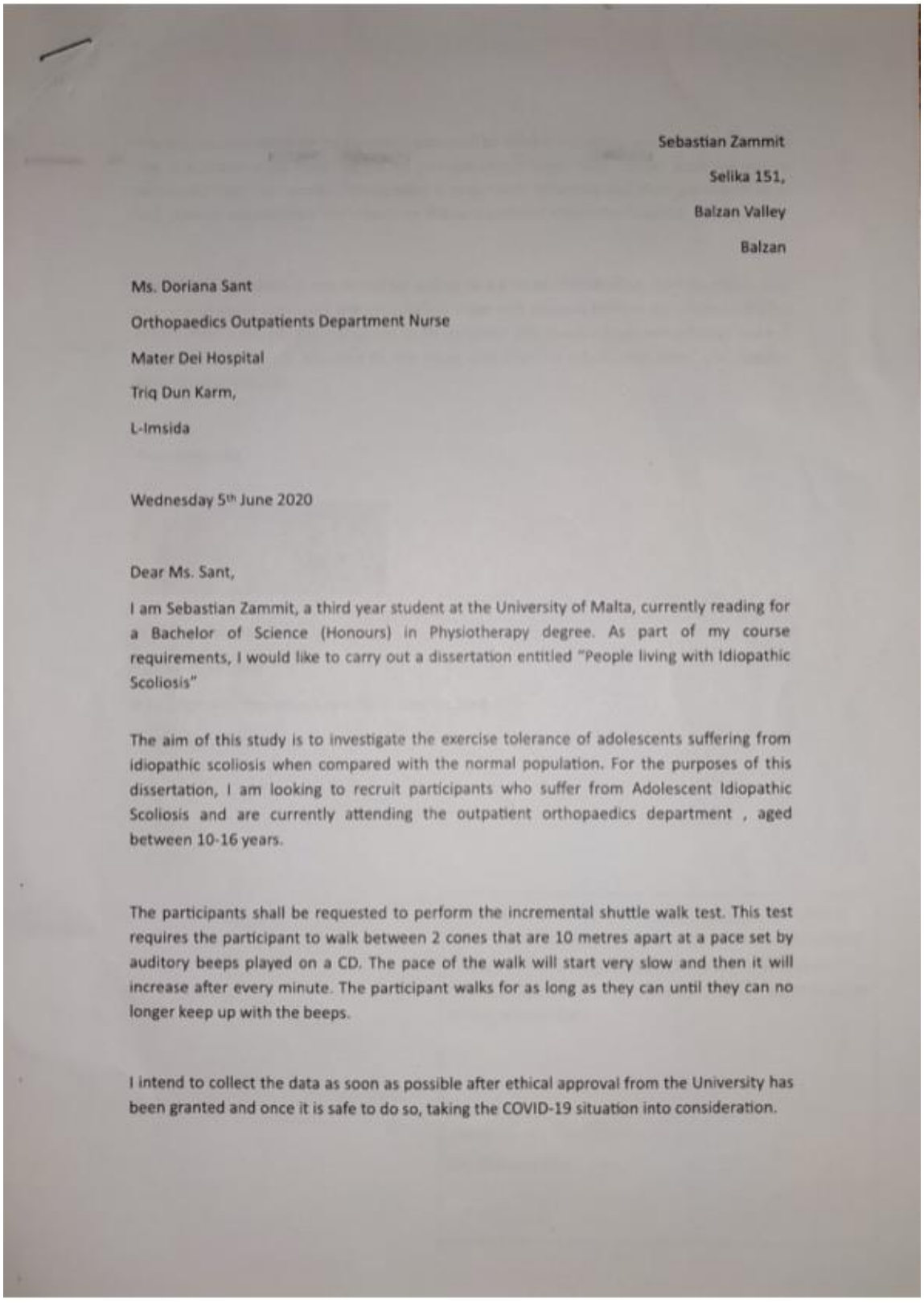
Ritienne Grima <ritienne.grima@um.edu.mt> 9 October 2020 at 13:29
To: Research Ethics HEALTHSCI <research-ethics.healthsci@um.edu.mt>
Cc: Sebastian Zammit <sebastian.zammit.17@um.edu.mt>, Tonio P Agius <tonio.p.agius@um.edu.mt>, Mireille Vincenti <physiomv@outlook.com>

Dear Sebastian
I confirm that you have provided the requested amendments.
Your application is approved on behalf of FREC.
Best wishes
Ritienne Grima

Ritienne Grima, Ph.D
Senior lecturer
Head, Department of Communication Therapy
Faculty of Health Sciences
University of Malta
Tel.: (+356) 2340 1142

[Quoted text hidden]

Appendix 2 – Signed Permissions



Sebastian Zammit

Selika 151,

Balzan Valley

Balzan

Ms. Doriana Sant

Orthopaedics Outpatients Department Nurse

Mater Dei Hospital

Triq Dun Karm,

L-Imsida

Wednesday 5th June 2020

Dear Ms. Sant,

I am Sebastian Zammit, a third year student at the University of Malta, currently reading for a Bachelor of Science (Honours) in Physiotherapy degree. As part of my course requirements, I would like to carry out a dissertation entitled "People living with Idiopathic Scoliosis"

The aim of this study is to investigate the exercise tolerance of adolescents suffering from idiopathic scoliosis when compared with the normal population. For the purposes of this dissertation, I am looking to recruit participants who suffer from Adolescent Idiopathic Scoliosis and are currently attending the outpatient orthopaedics department , aged between 10-16 years.

The participants shall be requested to perform the incremental shuttle walk test. This test requires the participant to walk between 2 cones that are 10 metres apart at a pace set by auditory beeps played on a CD. The pace of the walk will start very slow and then it will increase after every minute. The participant walks for as long as they can until they can no longer keep up with the beeps.

I intend to collect the data as soon as possible after ethical approval from the University has been granted and once it is safe to do so, taking the COVID-19 situation into consideration.

The information obtained from participants shall be stored in a secure environment and only the researcher shall have access to non-pseudonomysed data. Codes shall be stored separately from the results. Participation is completely voluntary and their participation or lack thereof, will not have any impact on the care pathway within the hospital.

I am therefore asking if you would be willing to act as an intermediary for this study. Your role would be to distribute the information letter and consent form in my absence and/or collect them if the participant wishes to fill the letter and consent form immediately and not use the postal option. Attached to this letter, also find the information letter and consent form for your perusal.

Yours Sincerely,

S. Zammit

Sebastian Zammit

I.D. No: 0220298M

B.Sc. (Hons) in Physiotherapy – Third Year Student

University of Malta.

I, the undersigned, have read Sebastian's request to act as an intermediary for their study and have understood all the information regarding to this study and what is required in order to collect the data. I hereby agree to act as his/her intermediary.

D Sant

Ms. Doriana Sant

Sebastian Zammit

151, Selika,

Triq il-wied,

Hal Balzan

Mr Ivan Esposito

Head of Orthopaedic Department

Mater Dei Hospital,

Triq Dun Karm,

L-Imsida

Friday 5th June, 2020

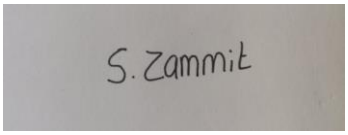
Dear Mr Esposito,

I am a third year student at the University of Malta, currently reading for a Bachelor of Science (Honours) in Physiotherapy degree. As part of my course requirements, I would like to carry out a dissertation entitled **"People living with Idiopathic Scoliosis"**

For the purposes of this dissertation, I am looking to recruit participants from the orthopaedic department at Mater Dei Hospital, aged between 10 and 16. The participants shall be requested to perform the incremental shuttle walk test. The results collected from participants shall be stored in a secure environment and only the researcher shall have access to the non-pseudonomysed data.

I am therefore writing to ask for your permission to recruit participants from the orthopaedics department, in order to adhere to ethical procedures.

Yours sincerely,



Sebastian Zammit

I.D. No: 0220298M

B.Sc. (Hons) in Physiotherapy – Third Year Student

University of Malta

L-Università ta' Malta

Sebastian Zammit <sebastian.zammit.17@um.edu.mt>

Re: [EXTERNAL] - Dissertation Approval

Esposito Ivan at Health-MDH <ivan.esposito@gov.mt> 6 June 2020 at 07:39
To: Sebastian Zammit <sebastian.zammit.17@um.edu.mt>
Cc: Mireille Vincenti <physiomv@outlook.com>

No objections
Regards
Ivan Esposito

From: Sebastian Zammit <sebastian.zammit.17@um.edu.mt>
Sent: 05 June 2020 20:45:44
To: Esposito Ivan at Health-MDH
Cc: Mireille Vincenti
Subject: [EXTERNAL] - Dissertation Approval

Dear Mr Esposito,

I hope that this email finds you well.

I have amended my dissertation title and attached to this email, kindly find my letters requesting permission, as well as the supporting documents (information letter and consent form) to be used in the data collection process.

Thanks, looking forward to hearing from you soon,

Sebastian Zammit

I.D. Card Numbers: 0220298M

B.Sc. (Hons) in Physiotherapy – Third Year Student

University of Malta

151, Selika,

Triq il-wied,

Hal Balzan

Ms Celia Falzon

Chief Executive Officer

Mater Dei Hospital,

Triq Dun Karm,

L-Imsida

Tuesday 9th June, 2020

Dear Ms Celia Falzon,

I am a third year student at the University of Malta, currently reading for a Bachelor of Science (Honours) in Physiotherapy degree. As part of my course requirements, I would like to carry out a dissertation entitled **"People living with Idiopathic Scoliosis"**

For the purposes of this dissertation, I am looking to recruit participants from the orthopaedic department at Mater Dei Hospital, aged between 10 and 16. The participants shall be requested to perform the incremental shuttle walk test. The results collected from participants shall be stored in a secure environment and only the researcher shall have access to the non-pseudonomysed data.

I am therefore writing to ask for your permission, in order to adhere to ethical procedures.

I have attached the approval of the Mater Dei Hospital, Data protection Officer as well as the information letter and consent form in english and maltese, the approval of Mr. Esposito and approval of the intermediary.

Yours sincerely,

Sebastian Zammit

I.D. No: 0220298M

B.Sc. (Hons) in Physiotherapy – Third Year Student

University of Malta

L-Università ta' Malta

Sebastian Zammit <sebastian.zammit.17@um.edu.mt>

RE: [EXTERNAL] - Dissertation Approval

CEO at Health-MDH <ceo.mdh@gov.mt> 10 June 2020 at 19:43
To: Sebastian Zammit <sebastian.zammit.17@um.edu.mt>

Dear Mr Zammit.

Please note that Ms Celia Falzon has granted approval for you to conduct this study in line with applicable hospital protocols.

Regards

Carmen Farrugia
Personal Assistant to the CEO

SPTAR MATER DEI

T +356 +356 25454102

E carmen.farrugia@gov.mt

Mater Dei Hospital, Triq Id-Donaturi Tad-Demm, Msida, Malta MSD 2090 | Tel +356 2545 0000 | https://careandcure.gov.mt/

From: Sebastian Zammit <sebastian.zammit.17@um.edu.mt>
Sent: Tuesday, 09 June 2020 20:53
To: CEO at Health-MDH <ceo.mdh@gov.mt>
Cc: Mireille Vincenti <physiomv@outlook.com>
Subject: [EXTERNAL] - Dissertation Approval

Data Protection Clearance Declaration Form

REF: 53/2020

I hereby declare that I will respect the confidentiality and privacy of any personal data or information that I will come across at Mater Dei and will in no circumstance disclose any such information to third parties.

I confirm that information submitted for Data Protection Clearance is correct and that I will abide with conditions issued in same clearance notice.

- **This clearance does not cover ethical approval.**
- **This clearance does not allow viewing of medical records nor access to Health Information Systems.**
- **Please communicate with the Charge Nurse at the Orthopaedic outpatient department before you start. You must also present this clearance letter both to the Charge Nurse and to your intermediary Ms Doriana Sant.**
- **All your participants must be reached and approached only when physically at MDH grounds and NOT via postal services, email, telephone or any other means. You cannot be handed any contact details of potential participants, otherwise consent would be bypassed and breach GDPR.**
- **Potential participants must be approached by your intermediary Ms Doriana Sant for invitation and not directly by your good self. If potential participants decide to participate, then you can walk in and start.**
- **Audio / video recordings and photography are not permitted for this study.**
- **Participant consent forms must be separated from all the collected data at source meaning that there will be no correlation between one and the other that will indicate how participants replied or their health status.**
- **ALL data presented to your supervisors / tutors or examiners or any other personnel from UOM or anyone else must be already anonymized; meaning that you must not divulge to anyone the identity of your participants and / or how they replied.**
- **Wording in the information letters and consent forms should address the parents / guardians since you will be interviewing adolescents. Since the legal age in Malta is 18 years, parents / guardians should sign the consent therefore replace the relevant wording**
- **e.g. :*"I understand that I have been invited to participate"* with *" I understand that my child has been invited to participate"***
- **Your submitted documentation and declarations must remain unchanged.**
- **What was declared during this clearance process is what you will abide to.**
- **You must abide with all the articles of the GDPR 2016 throughout the data collection process and thereafter.**

I also declare that I am aware of the provisions of the:

General Data Protection Regulation (2016)
(ref: https://idpc.org.mt/en/Pages/gdpr.aspx),
Computer misuse provisions of the Criminal Code
(ref: http://www.justiceservices.gov.mt/DownloadDocument.aspx?app=lom&itemid=8574),
and, the Professional Secrecy Act
(ref: http://www.justiceservices.gov.mt/DownloadDocument.aspx?app=lom&itemid=8844&l=1)

and that I will abide by all Government and Hospital regulations related to data, information and use of IT Systems and services (ref: http://ictpolicies.gov.mt , http://www.kura.gov.mt).

Full Name: Sebastian Zammit

ID/ Passport: 0220298M

Approval Date from DPO: 09th June 2020

Data Collection Period (From – To): September 2020 – October 2020

Approval Date from CEO: 10th June 2020

MDH Official Approval Names: Mr I Esposito

Name of Study / Audit: People living with Idiopathic Scoliosis

Applicant's Signature: S.Zammit
Sebastian zammit (Jun 25, 2020 11:35 GMT+2)

L-Università ta' Malta

Sebastian Zammit <sebastian.zammit.17@um.edu.mt>

Dissertation - Sebastian Zammit

Sebastian Zammit <sebastian.zammit.17@um.edu.mt> 29 September 2020 at 15:07
To: zachgatt11@gmail.com

Dear Mr Gatt,

I hope that this email finds you well.

I am a third year physiotherapy student currently reading for a Bachelor of Science (Honours) in Physiotherapy degree. As part of my course requirements, I would like to carry out a dissertation entitled “People living with Idiopathic scoliosis”.

Attached to this email, kindly find the information letter and consent form to be used in the data collection process.

Will you be able to supervise this study during the data collection?

Thanks look forward to hearing from you soon,

Sebastian Zammit
I.D. Card Numbers: 0220298M
B.Sc. (Hons) in Physiotherapy – Third Year Student
University of Malta

2 attachments

Information letter english RED.pdf
607K

information letter Maltese RED.pdf
614K

L-Università ta' Malta

Sebastian Zammit <sebastian.zammit.17@um.edu.mt>

Dissertation - Sebastian Zammit

Zach Gatt <zachgatt11@gmail.com> 2 October 2020 at 08:03
To: Sebastian Zammit <sebastian.zammit.17@um.edu.mt>

Good morning,

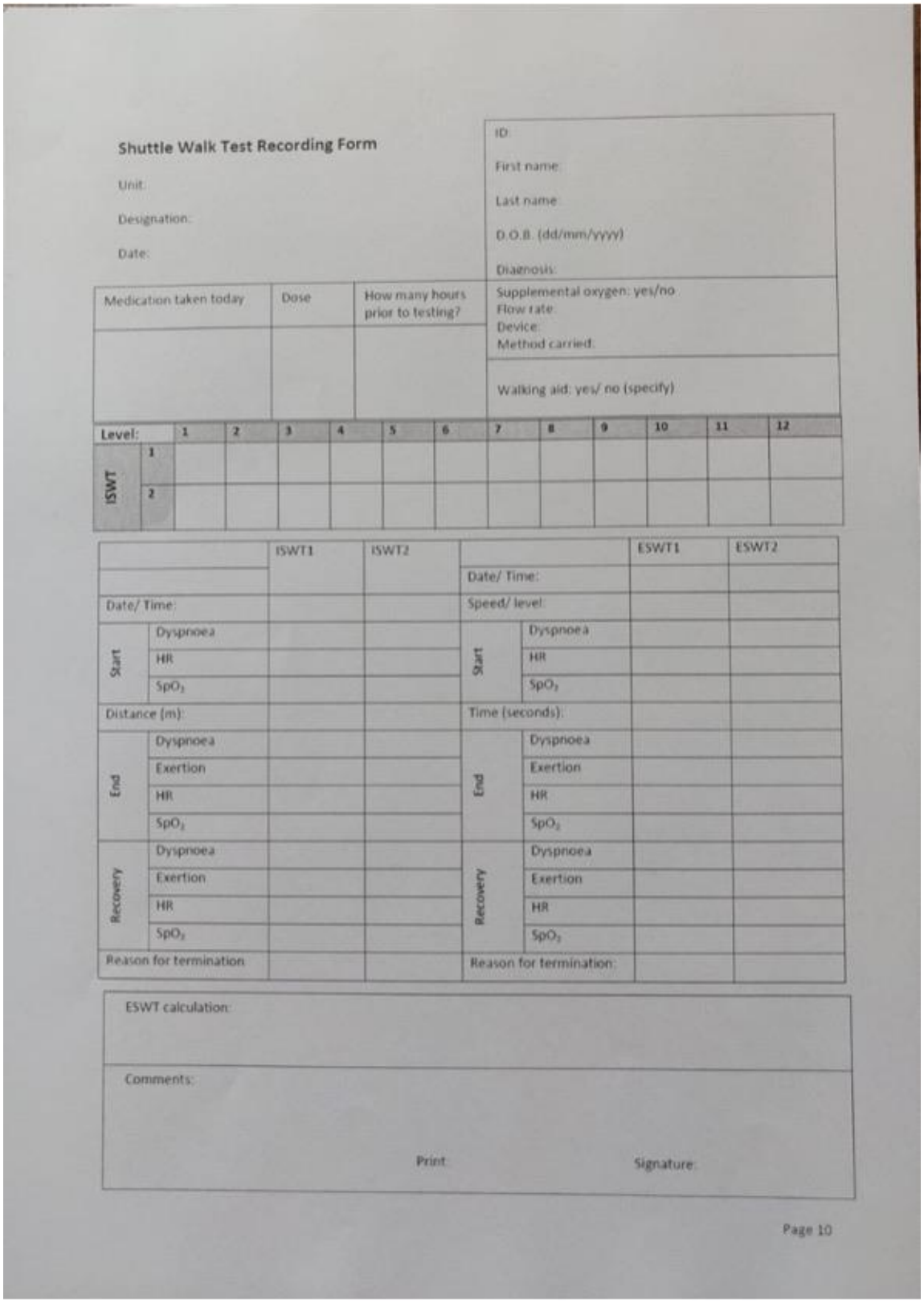
I confirm that I will be available to supervise this study.

Looking forward,

Thanks

Zachary Gatt
CPCM 248
[Quoted text hidden]

Appendix 3 – Tools



Shuttle Walk Test Recording Form

Unit:

Designation:

Date:

ID:

First name:

Last name:

D.O.B. (dd/mm/yyyy)

Diagnosis:

Medication taken today	Dose	How many hours prior to testing?

Supplemental oxygen: yes/no
Flow rate:
Device:
Method carried:

Walking aid: yes/ no (specify)

Level:		1	2	3	4	5	6	7	8	9	10	11	12
ISWT	1												
	2												

		ISWT1	ISWT2			ESWT1	ESWT2
				Date/ Time:			
Date/ Time:				Speed/ level:			
Start	Dyspnoea			Start	Dyspnoea		
	HR				HR		
	SpO_2				SpO_2		
Distance (m):				Time (seconds):			
End	Dyspnoea			End	Dyspnoea		
	Exertion				Exertion		
	HR				HR		
	SpO_2				SpO_2		
Recovery	Dyspnoea			Recovery	Dyspnoea		
	Exertion				Exertion		
	HR				HR		
	SpO_2				SpO_2		
Reason for termination:				Reason for termination:			

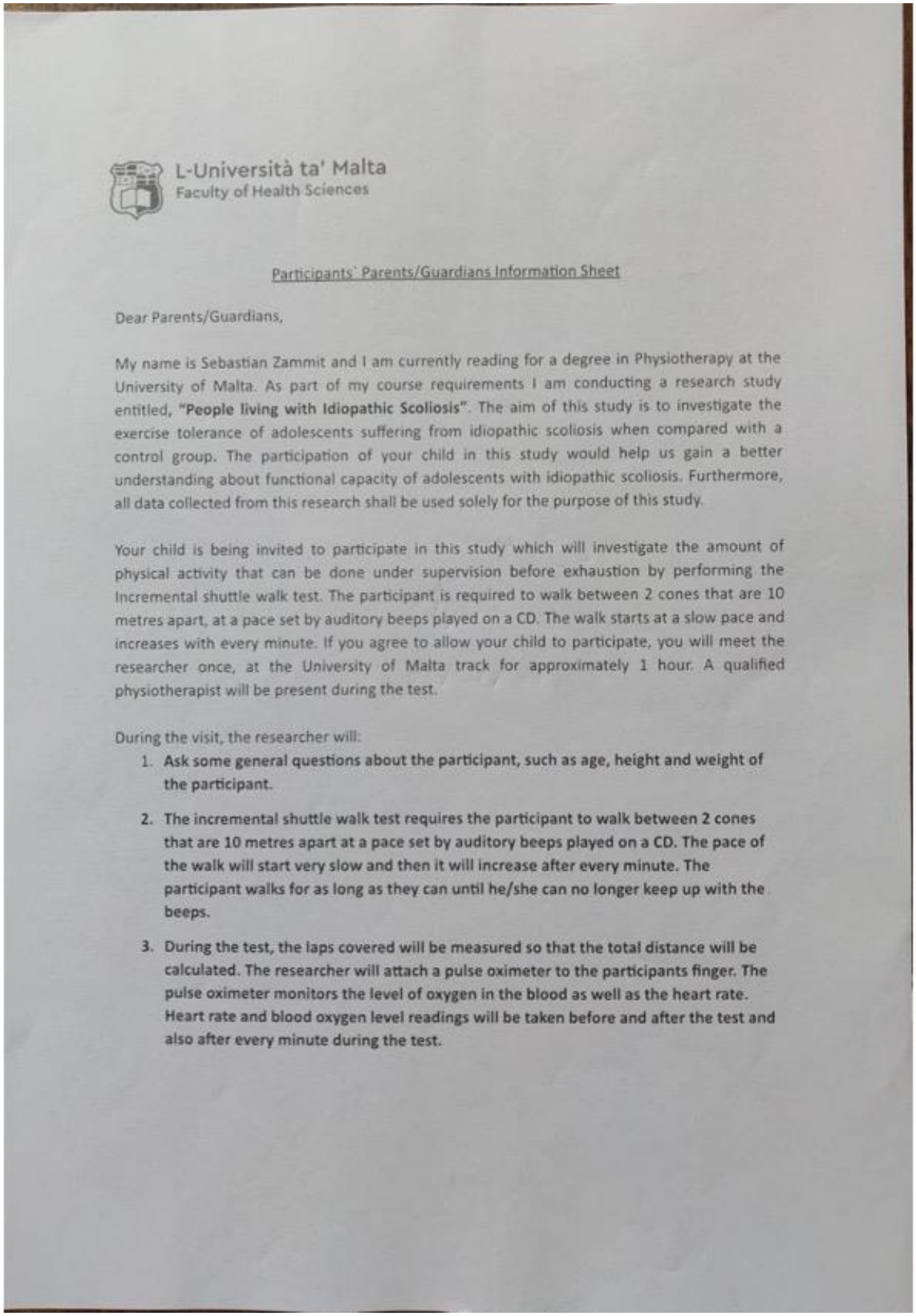
ESWT calculation:

Comments:

Print: Signature:

Page 10

Appendix 4 – Information letters, consent forms and exclusion criteria



L-Università ta' Malta
Faculty of Health Sciences

Participants' Parents/Guardians Information Sheet

Dear Parents/Guardians,

My name is Sebastian Zammit and I am currently reading for a degree in Physiotherapy at the University of Malta. As part of my course requirements I am conducting a research study entitled, **"People living with Idiopathic Scoliosis"**. The aim of this study is to investigate the exercise tolerance of adolescents suffering from idiopathic scoliosis when compared with a control group. The participation of your child in this study would help us gain a better understanding about functional capacity of adolescents with idiopathic scoliosis. Furthermore, all data collected from this research shall be used solely for the purpose of this study.

Your child is being invited to participate in this study which will investigate the amount of physical activity that can be done under supervision before exhaustion by performing the Incremental shuttle walk test. The participant is required to walk between 2 cones that are 10 metres apart, at a pace set by auditory beeps played on a CD. The walk starts at a slow pace and increases with every minute. If you agree to allow your child to participate, you will meet the researcher once, at the University of Malta track for approximately 1 hour. A qualified physiotherapist will be present during the test.

During the visit, the researcher will:

1. **Ask some general questions about the participant, such as age, height and weight of the participant.**
2. **The incremental shuttle walk test requires the participant to walk between 2 cones that are 10 metres apart at a pace set by auditory beeps played on a CD. The pace of the walk will start very slow and then it will increase after every minute. The participant walks for as long as they can until he/she can no longer keep up with the beeps.**
3. **During the test, the laps covered will be measured so that the total distance will be calculated. The researcher will attach a pulse oximeter to the participants finger. The pulse oximeter monitors the level of oxygen in the blood as well as the heart rate. Heart rate and blood oxygen level readings will be taken before and after the test and also after every minute during the test.**

Your child is not obliged to participate in this study and may withdraw from the study at any time without giving a reason. Furthermore, withdrawal from the study will not have any negative repercussions and any data collected will be erased. Data will be stored anonymously if it is impossible to delete (e.g. if it has already been anonymised). Confidentiality will be maintained throughout the study and that the identity of your child and personal information will not be revealed in any publications, reports or presentations arising from this research. All data collected will be pseudonymised meaning that the data will be assigned codes and that this data will be stored securely and separately from any codes and personal data.

This data may only be accessed by the researcher. The academic supervisor and the examiners will typically have access to coded data only. There are no audio-recordings. Any material in hard-copy form will be placed in a locked cupboard.

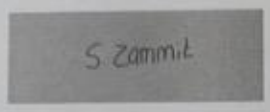
In order to reduce physical risks such as falling, possible ankle injury or dizziness, two chairs will be placed along the track were the test will be performed just in case the participant feels tired and wants to sit down. In addition, throughout the test continuous feedback regarding any shortness of breath and the participants current state will be monitored. Shortness of breath is normal during the test. The guardians/parents of the participants will be advised to provide proper footwear such as running shoes for their children. Children wearing sliders or flip-flops will not be able to perform the test. In addition, adequate clothing is also important such as sport wear including t-shirt and shorts.

Participation in this study is completely voluntary and your child is free to accept or refuse to take part without giving a reason. The participants can keep a copy of the information sheet and consent form. As a participant, you have the right, under the General Data Protection Regulation (GDPR) and national legislation that implements and further specifies the relevant provisions of said regulation, to access, rectify and where applicable ask for the data concerning you to be erased. Once the study is completed and the results are published, the data will be retained in anonymous form. Any personal details will be destroyed.

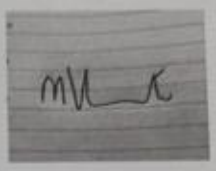
This study has been approved by the Research Ethics Committee of the Faculty of Health Sciences at the University of Malta.

Thank you for your time and consideration. Should you have any questions or concerns do not hesitate to contact me on +35699676745 or by e-mail sebastian.zammit.17@um.edu.mt or my supervisor Mrs. Mireille Vincenti on physiomv@outlook.com.

Yours Sincerely,



Sebastian Zammit



Mireille Vincenti

L-Università ta' Malta
Faculty of Health Sciences

Participants' Parents/Guardians Consent Form

"People living with Idiopathic Scoliosis"

I, the undersigned, give my consent to take part in the study conducted by Sebastian Zammit. The purpose of this document is to specify the terms of my participation in this research study.

1. I have been given written and verbal information by the intermediary about the purpose of the study and all questions have been answered.
2. I understand that my child has been invited to participate in a study, in which the researcher will perform tests to investigate the exercise tolerance of adolescents suffering from idiopathic scoliosis when compared with a population who do not suffer from idiopathic scoliosis.
3. I am aware that the meeting will take approximately 1 hour. I understand that the meeting is to be conducted at the University of Malta track.
4. I am aware that there will be no audio-recordings.
5. I am aware that a qualified physiotherapist will be present during the test.
6. I am aware that the data collected will be coded and that this data will be stored securely and separately from any codes and personal data.
7. I am aware that the researcher is the only person who has access to this data. The academic supervisor and examiners will typically have access to coded data only.
8. I am also aware that the coded data files will be stored on the researchers personal computer that is password protected and in an encrypted format. Any material in hard-copy form will be placed in a locked cupboard and kept until results are published.
9. I am aware that the identity of my child and personal information will not be revealed in any publications, reports or presentations arising from this research.
10. I also understand that I am free to accept, refuse or stop participation of my child at any time without giving any reason. This will have no negative repercussions on myself and that any data collected form me will be erased. Data will be stored anonymously if it is impossible to delete (e.g. if it has already been anonymised).
11. I also understand that the contribution of my child in this study will serve to increase the knowledge regarding exercise tolerance in patients with adolescent idiopathic scoliosis and help us understand further the condition.
12. I understand that under the General Data Protection Regulation (GDPR) and national legislation that implements and further specifies the relevant provisions of said

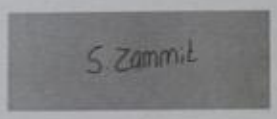
regulation, I have the right to access, rectify, and where applicable ask for the data concerning me to be erased.

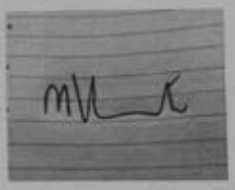
13. I also understand that once the study is completed and results are published the data will be retained in anonymous form. Any personal details of my child will be destroyed.
14. I will be provided with a copy of the information letter and consent form for future reference.
15. I have read and understood the points and statements of this form. I have had all the questions answered to my satisfaction, and I agree to participate in this study.

Participant: _____

Signature: _____

Date: _____





Sebastian Zammit
Researcher
+35699676745

Mireille Vincenti
Research Supervisor

L-Università ta' Malta

CONSENT FORM

The aims and details of the project on "People living with Idiopathic Scoliosis" have been explained to me by the intermediary Ms.Sant. I have also explained to my child what this study entails.

The aim of this study is to investigate the exercise tolerance of adolescents suffering from idiopathic scoliosis when compared with a control group. The participation of your child in this study would help us gain a better understanding about functional capacity of adolescents with idiopathic scoliosis.

Participation in this study should take approximately 1 hour.

The incremental shuttle walk test requires the participant to walk between 2 cones that are 10 metres apart at a pace set by auditory beeps played on a CD. The pace of the walk will start very slow and then it will increase after every minute. The participant walks for as long as they can until he/she can no longer keep up with the beeps.
During the test, the laps covered will be measured so that the total distance will be calculated. The researcher will attach a pulse oximeter to the participants finger. The pulse oximeter monitors the level of oxygen in the blood as well as the heart rate. Heart rate and blood oxygen level readings will be taken before and after the test and also after every minute during the test.

In order to reduce physical risks such as falling, possible ankle injury or dizziness, two chairs will be placed along the pathway were the test will be performed just in case the participant feels tired and wants to sit down. In addition, throughout the test continuous feedback regarding any shortness of breath and current state will be monitored. Shortness of breath is normal during the test.

Participants can withdraw from the study at any time without giving a reason.

I know that the information collected will remain confidential, and that it will be used only for scientific purposes. The data will be pseudonymised. I also know that a written report of the study will be drawn up, and that myself/my child will not be identified in any way in this report. I know that data including video/audio-recordings will be password protected, kept safely under lock and key and deleted once the study is completed.

I therefore give my consent to the person responsible for the research to make the necessary observations on my child.

I am aware that I am under no obligation to do so, and that I can withdraw my consent at any moment without giving any reason.

Name of participant: .....

Signature: .....

Name of Parent/Guardian: .....

Telephone number: .....

Signature: .....

Name of person responsible for the study:

Sebastian Zammit

Signature: S Zammit

L-Università ta' Malta
Faculty of Health Sciences

Formula ta' Informazzjoni għall-Genituri/Gwardjani tal-Parteċipanti

Għeżież Genituri/Gwardjani,

Jiena Sebastian Zammit, fil-preżent qiegħed insegwi grad fil-kors tal-fiżjoterapija fl-Università ta' Malta. Bħala parti mir-rekwiżiti tal-kors, qed nagħmel riċerka bit-titlu, **"Nies li jgħixu bi skoljożi idjopatika"**. L-għan ta' dan l-istudju hu li ninvestiga t-tolleranza għall-eżerċizzju ta 'adolexxenti li jbatu minn skoljożi idjopatika meta mqabbla ma grupp ta' kontroll. Is-sehem tat-tifel/tifla tiegħek f'dan l-istudju jista' jgħin biex ikollna aktar għarfien dwar il-kapaċità funzjonali tal-adolexxenti li jbatu bi skoljożi idjopatika. Kull informazzjoni miġbura tintuża biss għall-għan jew l-għanijiet ta' dan l-istudju.

Bħala parteċipant/a t-tifel/tifla tiegħek se j/tintalab j/tieħu sehem f'dan l-istudju sabiex ninvestigaw l-ammont ta' attività fiżika li tista' ssir taħt sorveljanza qabel j/tgħejja, billi nużaw it-test inkrementali ta' 'shuttle walk'. Dan it-test jirrikjedi li l-parteċipant/a jimxi bejn żewġ koni li jkunu għaxar metri l-bogħod, b'pass stabbilit minn ħoss li jdoqq fuq CD. Ir-ritmu tal-mixja se jibda bil-mod ħafna u se jiżdied wara kull minuta. Il-parteċipant/a t/jimxi kemm jista jkun sakemm ma jkunux jistgħu jibqgħu ilaħħqu mal-ħoss. Jekk taċċetta li t-tifel/tifla tiegħek j/tieħu sehem inti tintalab sabiex tiltaqa' mar-riċerkatur Sebastian Zammit, darba biss fit-trakka tal-Universita ta' Malta. Din il-laqgħa se tieħu madwar siegħa. Fiżjoterapista Kwalifikat se jkun preżenti matul it-test.

Waqt din il-laqgħa ir-riċerkatur jkun jista':

1. **Jistaqsi xi mistoqsijiet dwar it-tifel/tifla tiegħek, perożempju l-età', it-tul u il-piż tat-tifel/tifla tiegħek.**
2. **It-test li se jintuża huwa it-test inkrementali ta' 'shuttle walk' li jirrikjedi li l-parteċipant/a jimxi bejn żewġ koni li jkunu għaxar metri l-bogħod, b'pass stabbilit minn ħoss li jdoqq fuq CD. Ir-ritmu tal-mixja se jibda bil-mod ħafna u se jiżdied wara kull minuta. Il-parteċipant/a t/jimxi kemm jista jkun sakemm ma jkunux jistgħu jibqgħu ilaħħqu mal-ħoss.**
3. **Matul it-test, id-dawriet magħmula ħa jiġu mkejjla sabiex id-distanza totali koperta tkun tista 'tiġi kkalkulata. Ir-riċerkatur ħa juża 'pulse-oximeter', dan jintlibes ma 'saba' tal-parteċipant/a. Dan il 'pulse oximeter' jissorvelja il-livell ta ossiġnu fid-demm u kif ukoll ir-rata tal-qalb. Il-qari tar-rata tal-qalb u tal-livell ta' ossiġnu fid-demm għandhom jittieħdu qabel u wara t-test u wkoll wara kull minuta matul it-test.**

It-tifel/tifla tiegħek mhux obbligat/a li tipparteċipa u tista' twaqqaf l-istudju fi xħin trid mingħajr ma tagħti l-ebda raġuni. Dan mhux ħa jkollu riperkussjonijiet negattivi fuqek u l-informazzjoni li

tingabar minghandek tithassar. Id-data se tinhażen b'mod anonimu kemm-il darba jkun impossibbli li tithassar (eż. jekk diġà kienet anonimizzata). L-awdjo mhux ha jkun użat. Il-kunfidenzjalità se tinżamm matul l-istudju kollu u l-identità tat-tifel/tifla tiegħek u kull informazzjoni personali miġbura m'huma se jiġu żvelati mkien fit-teżi, ir-rapporti, il-preżentazzjonijiet u/jew il-pubblikazzjonijiet li jistgħu jirriżultaw minnha. Kull tagħrif miġbur se jiġi psewdonomizzat, jiġifieri id-data kollha se tkun protetta permezz ta' sistema ta' kodiċi u miżmuma separatament mill-informazzjoni personali. Ir-riċerkatur biss ser ikollu aċċess għall-informazzjoni miġbura, filwaqt li s-Superviżura akkademika u l-eżaminaturi se jkollhom biss access għal data kkodifikata.

Id-data kollha se jinħażnu fuq il-kompjuter personali tar-Riċerkatur permezz ta' kodifikazzjoni tad-data (data encryption) u li hi protetta b'password. Barra minn hekk, il-materjal stampat se jinqafel f'post sigur.

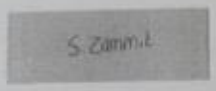
Sabiex jitnaqqsu r-riskji fiżiċi bħal waqgħa, jew sturdament, żewġ siġġijiet se jitpoġġew tul il-passaġġ fejn se jsir it-test fil-każ li l-parteċipant/a jhossu/thossa għajjien/a u j/trid j/toqgħod bilqiegħda. Barra minn hekk, matul it-test il-parteċipant ha jkun mistoqsi dwar l-istat tan-nifs tiegħu/tagħha. Nuqqas ta 'nifs waqt it-test huwa normali. Barra minn hekk, il-ġenituri tal-parteċipanti se jiġu mgħarfin sabiex jilbsu żraben u ħwejjeġ addatati għal-eżerċizju. Jekk il-parteċipant/a jkunu libsin krakar jew sandli, ma jkunux jistgħu jagħmlu it-test.

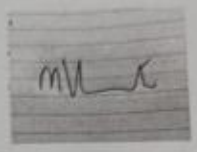
Il-parteċipazzjoni tat-tifel/tifla tiegħek f'dan l-istudju hija għażla għal kollox volontarja u inti ħieles/ħielsa li taċċetta jew tirrifjuta li tħalli lit-tifel/tifla j/tieħu sehem mingħajr ma jkun hemm konsegwenzi fil-konfront tiegħek. Il-parteċipant/a se j/tingħata kopja tal-ittra ta' informazzjoni u tal-formula ta' kunsens. Barra minn hekk, skont ir-Regolamenti Ġenerali dwar il-Protezzjoni tad-Data (GDPR) u l-leġiżlazzjoni nazzjonali li timplimenta u tispeċifika aktar il-provvedimenti relevanti tar-regolamenti msemmija, inti għandek id-dritt li taċċessa, tirretifika, u fejn japplika titlob sabiex tithassar id-data li tikkonċerna lilek. L-informazzjoni personali kollha se tithassar hekk kif jintemm dan l-istudju ta' riċerka u jkunu ppubblikati r-riżultati miksuba.

Dan l-istudju ġie approvat mill-Kumitat għall-Etika fir-Riċerka fi ħdan il-Fakultà tax-Xjenzi tas-Saħħa fl-Università ta' Malta.

Grazzi ħafna tal-ħin u s-sehem tiegħek f'dan l-istudju. F'każ li jkollok xi mistoqsijiet jew tixtieq tiċċara xi ħaġa, tista' ċċempilli fuq +35699676745 jew tibgħatli email fuq sebastian.zammit.17@um.edu.mt. Tista' wkoll tikkuntattja lis-Superviżura Mrs. Mireille Vincenti billi tibgħat email fuq physiomv@outlook.com.

Dejjem tiegħek,





Sebastian Zammit

Mireille Vincenti

L-Università ta' Malta
Faculty of Health Sciences

Formula ta' Kunsens tal-Genituri/Gwardjani Parteċipanti

"Nies li jgħixu bi skoljożi idjopatika"

Jien, hawn taħt iffirmat/a, nagħti l-kunsens tiegħi biex it-tifel/tifla tiegħi j/tieħu sehem fl-istudju mmexxi minn Sebastian Zammit. L-għan ta' dan id-dokument hu li jiġu speċifikati t-termini tal-parteċipazjoni tat-tifel/tifla tiegħi f'dan l-istudju ta' riċerka.

1. Jien ingħatajt informazzjoni miktuba u verbali mingħand l-intermedjarja dwar l-għan tal-istudju u l-mistoqsijiet koliha twieġbu.
2. Nifhem li t-tifel/tifla se j/tkun qed j/tipparteċipa fi studju, fejn ir-Riċerkatur ħa jinvestiga t-tolleranza għall-eżerċizzju ta 'adolexxenti li jbatu minn skoljożi idjopatika meta mqabbla mal-popolazzjoni normali.
3. Naf li l-istudju se jieħu madwar siegħa. Nifhem, li l-laqgħa se ssirfit-trakka tal-universita ta' Malta.
4. Fiżjoterapista Kwalifikat se jkun preżenti matul it-test.
5. L-awdjo mhux se jintuża.
6. Naf ukoll li se ssir kodifikazzjoni tad-data u din se tinżamm separatament mill-informazzjoni personali.
7. Naf ukoll li r-Riċerkatur hu l-uniku persuna li se jkollu aċċess għal din l-informazzjoni, filwaqt li s-Superviżura akkademika u l-eżaminaturi se jkollhom aċċess għal data kkodifikata biss.
8. Barra min hekk, naf li d-data se tinħażen fuq il-kompjuter personali tar-Riċerkatur permezz ta' kodifikazzjoni tad-data (data encryption) u li hi protetta b'password. Barra minn hekk, naf li l-materjal stampat se jitqiegħed f'post sigur u se jinżamm sakemm joħorġu r-riżultati.
9. Naf li l-identità tat-tifel/tifla tiegħi u l-informazzjoni personali mhuma se jinkixfu mkien fit-teżi, fir-rapporti, fil-preżentazzjonijiet u/jew fil-pubblikazzjonijiet li jistgħu jirriżultaw minnha.
10. Nifhem ukoll li jien liberu/a li naċċetta, nirrifjuta jew inwaqqaf il-parteċipazzjoni tat-tifel/tifla tiegħi f'kull ħin bla ma nagħti raġuni. Dan mhux ħa jkollu riperkussjonijiet negattivi fuqi. Nifhem ukoll li la darba nirtira minn dan l-istudju, l-informazzjoni miġbura se titħassar. Id-data se tinħażen b'mod anonimu kemm-il darba jkun impossibbli li titħassar (eż. jekk diġà kienet anonimizzata).

11. Nifhem ukoll li l-kontribuzzjoni tat-tifel/tifla tieghi ser isservi biex' ngħin biex ikollna aktar għarfien dwar il-kapaċità funzjonali tal-adolexxenti bi scoliosi idjopatika.
12. Nifhem ukoll, li skont ir-Regolamenti Generali dwar il-Protezzjoni tad-Data (GDPR) u l-legizlazzjoni nazzjonali li timplimenta u tispecifika aktar il-provvedimenti relevanti tar-regolamenti msemmija, jiena għandi d-dritt li naċċessa, nirretifika, u fejn japplika nitlob sabiex titħassar id-data li tikkonċernani.
13. Naf ukoll li meta jintemm l-istudju u r-riżultati jkunu ppubblikati, l-informazzjoni personali migbura titħassar.
14. Fl-aħħar nett, naf ukoll li se ninġħata kopja tal-ittra ta' informazzjoni u tal-formula ta' kunsens sabiex inkun nista' naċċessahom fil-futur.
15. Jien qrajt u fhimt il-punti u d-dikjarazzjonijiet f'din il-formula. Inħossni sodisfatt/a bit-twegibiet li ngħatajt għall-mistoqsijiet li kelli, u qed naċċetta minn jeddi li nipparteċipa f'dan l-istudju.

Parteċipant:_____

Firma:_____

Data:_____

Mireille Vincenti :

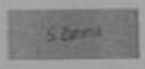
physiomv@outlook.com

Sebastian Zammit:

sebastian.zammit.17@um.edu.mt

Firma: 

Data: _____

Firma: 

Data: _____

L-Università ta' Malta

Formola ta' kunsens

L-iskop u d-dettalji tal-progett "Nies li jgħixu bi skoljożi idjopatika" gew spjegati mil-intermedjarja Ms.Sant. Jiena stess spjegajt lit-tifel /tifla tiegħi dak li ser isir.

L-għan ta' dan l-istudju hu li ninvestiga t-tolleranza għall-eżerċizzju ta 'adolexxenti li jbatu minn skoljożi idjopatika meta mqabbla ma grupp ta' kontroll. Is-sehem tat-tifel/tifla tiegħek f'dan l-istudju jista' jgħin biex ikollna aktar għarfien dwar il-kapaċità funzjonali tal-adolexxenti li jbatu bi skoljożi idjopatika. Kull informazzjoni miġbura tintuża biss għall-għan jew l-għanijiet ta' dan l-istudju.

Dan it-test jieħu madwar siegħa u t-tifel/tifla j/trid j/tagħħmlu darba.
It-test li se jintuża huwa it-test inkrementali ta' 'shuttle walk' li jirrikjedi li l-parteċipant/a jimxi bejn żewg koni li jkunu għaxar metri l-bogħod, b'pass stabbilit minn ħoss li jdoqq fuq CD. Ir-ritmu tal-mixja se jibda bil-mod ħafna u se jizdied wara kull minuta. Il-parteċipant/a t/jimxi kemm jista jkun sakemm ma jkunux jistgħu jibqgħu ilaħħqu mal-ħoss.

Matul it-test, id-dawriet magħmula ħa jiġu mkejjla sabiex id-distanza totali koperta tkun tista 'tiġi kkalkulata. Ir-riċerkatur ħa juża 'pulse-oximeter', dan jintlibes ma 'saba' tal-parteċipant/a. Dan il 'pulse oximeter' jissorvelja il-livell ta ossiġnu fid-demm u kif ukoll ir-rata tal-qalb. Il-qari tar-rata tal-qalb u tal-livell ta' ossiġnu fid-demm għandhom jittieħdu qabel u wara t-test u wkoll wara kull minuta matul it-test.

Sabiex jitnaqqsu r-riskji fiżiċi bħal waqgħa, jew sturdament, żewġ siġġijiet se jitpoġġew tul il-passaġġ fejn se jsir it-test fil-każ li l-parteċipant/a jħossu/ thossa għajjien/a u j/trid j/toqgħod bilqiegħda. Barra minn hekk, matul it-test il-parteċipant ħa jkun mistoqsi dwar l-istat tan-nifs tiegħu/tagħha. Nuqqas ta 'nifs waqt it-test huwa normali.

Il-parteċipant/a j/tista j/tieqaf minn dan l-istudju meta j/trid mingħajr ma tinata raġuni.

Jiena naf li l-informazzjoni miġbura ser tinżamm b'mod kunfidenzjali, u li ser tintuża biss għal skopijiet xjentifiċi. Naf ukoll li ser isir rapport bil-miktub tar-riżultati, u li meta jsir dan, jiena/it-tifel/tifla tiegħi bl-ebda mod m'aħna ser inkunu nistgħu niġu identifikati. L-informazzjoni miġbura, inkluża l-'*video/*

audio recording' ser tiġi protetta minn '*password*' u meqruda meta jispiċċa l-istudju.

Għalhekk qed nagħti l-kunsens tiegħi lill-persuna responsabbli għal din ir-riċerka biex tagħmel l-osservazzjonijiet li hemm bżonn fuq it-tifel/ tifla tiegħi.

Naf li ma għandi l-ebda dmir nagħmel dan, u li nista' nirtira fi kwalunkwe punt, mingħajr ma nagħti raġuni.

Isem tal-parteċipant: .....

Firma: .....

Isem tal-genitur/gwardjan: .....

Numru tat-telefon: .....

Firma: .....

Isem tal-persuna responsabbli għall-istudju:

Sebastian Zammit

Firma:

S Zammit

Exclusion Criteria

Absolute Contraindications:	Yes	No
Acute Myocardial Infarction (3-5 days)		
Unstable angina		
Uncontrolled arrhythmias causing symptoms or haemodynamic compromise		
Syncope		
Active endocarditis		
Acute myocarditis or pericarditis		
Symptomatic severe aortic stenosis		
Uncontrolled heart failure		
Acute pulmonary embolus or pulmonary infarction		
Thrombosis of lower extremities Suspected dissecting aneurysm		
Uncontrolled asthma		
Pulmonary oedema		
Acute respiratory failure		
Acute non-cardiopulmonary disorder that may affect exercise performance or be aggravated by exercise (i.e. infection, renal failure, thyrotoxicosis)		
Mental impairment leading to inability to cooperate		
Physical impairment		
Diabetes		

Relative Contraindications:	Yes	No
Left main coronary stenosis or its equivalent		
Moderate stenotic valvular heart disease		
Severe untreated arterial hypertension at rest		
Tachyarrhythmias or bradyarrhythmia's		
High-degree atrioventricular block		
Hypertrophic cardiomyopathy		
Significant pulmonary hypertension		
Electrolyte abnormalities		
Orthopedic impairment that prevents walking		

Shuttle Walk Test Recording Form

Unit:

Designation:

Date: 23/01/21

ID: /

First name: [redacted]

Last name:

D.O.B. (dd/mm/yyyy) 2004 - 16yrs

Diagnosis: Scoliosis

Medication taken today	Dose	How many hours prior to testing?
/	/	/

Supplemental oxygen: ~~yes~~/no
Flow rate:
Device:
Method carried:

Walking aid: ~~yes~~/no (specify)

Level:		1	2	3	4	5	6	7	8	9	10	11	12
ISWT	1	3	4	5	6	7	8	9	10	10	0	0	0
	2	3	4	5	6	7	8	9	10	11	2	0	0

		ISWT1	ISWT2			ESWT1	ESWT2
				Date/ Time:			
Date/ Time: 23/01/21				Speed/ level:			
Start	Dyspnoea	0	0	Start	Dyspnoea		
	HR	82	84		HR		
	SpO_2	98%	98%		SpO_2		
Distance (m):		620m	650m	Time (seconds):			
End	Dyspnoea	3	3	End	Dyspnoea		
	Exertion	9	9		Exertion		
	HR	137	140		HR		
	SpO_2	96%	95%		SpO_2		
Recovery	Dyspnoea	0	0	Recovery	Dyspnoea		
	Exertion	/	/		Exertion		
	HR	74	74		HR		
	SpO_2	98%	98%		SpO_2		
Reason for termination		Did not reach target		Reason for termination:			

~~Shuttle duration~~

Peak VO_2 19.69 20.44

Comments:
height - 163
Weight - 52
Cobb angle - 32°

Print:

Signature: S. Zammit

11. Nifhem ukoll li l-kontribuzzjoni tat-tifel/tifla tiegħi ser isservi biex' nghin biex ikollna aktar għarfien dwar il-kapaċità funzjonali tal-adolexxenti bi scoliosi idjopatika.
12. Nifhem ukoll, li skont ir-Regolamenti Ġenerali dwar il-Protezzjoni tad-Data (GDPR) u l-leġizlazzjoni nazzjonali li timplimenta u tispeċifika aktar il-provvedimenti relevanti tar-regolamenti msemmija, jiena għandi d-dritt li naċċessa, nirrettifika, u fejn japplika nitlob sabiex titħassar id-data li tikkonċernani.
13. Naf ukoll li meta jintemm l-istudju u r-riżultati jkunu ppubblikati, l-informazzjoni personali miġbura titħassar.
14. Fl-aħħar nett, naf ukoll li se ninġħata kopja tal-ittra ta' informazzjoni u tal-formula ta' kunsens sabiex inkun nista' naċċessahom fil-futur.
15. Jien qrajt u fhimt il-punti u d-dikjarazzjonijiet f'din il-formula. Inħossni sodisfatt/a bit-tweġibiet li ngħatajt għall-mistoqsijiet li kelli, u qed naċċetta minn jeddi li nipparteċipa f'dan l-istudju.

Partečipant: [redacted]

Firma: _____

Data: 23/01/21

Mireille Vincenti :

physiomv@outlook.com

Firma: _____

Data: _____

Sebastian Zammit:

sebastian.zammit.17@um.edu.mt

Firma: _____

Data: _____

audio recording ser tiġi protetta minn '*password*' u meqruda meta jispiċċa l-istudju.

Għalhekk qed nagħti l-kunsens tiegħi lill-persuna responsabbli għal din ir-riċerka biex tagħmel l-osservazzjonijiet li hemm bżonn fuq it-tifel/ tifla tiegħi.

Naf li ma għandi l-ebda dmir nagħmel dan, u li nista' nirtira fi kwalunkwe punt, minghajr ma nagħti raġuni.

Isem tal-parteċipant: [redacted]

Firma: .....

Isem tal-genitur/gwardjan: [redacted]

Numru tat-telefon: [redacted]

Firma: .....

Isem tal-persuna responsabbli għall-istudju:

Sebastian Zammit

Firma:

S Zammit

Exclusion Criteria

Absolute Contraindications:	Yes	No
Acute Myocardial Infarction (3-5 days)		✓
Unstable angina		✓
Uncontrolled arrhythmias causing symptoms or haemodynamic compromise		✓
Syncope		✓
Active endocarditis		✓
Acute myocarditis or pericarditis		✓
Symptomatic severe aortic stenosis		✓
Uncontrolled heart failure		✓
Acute pulmonary embolus or pulmonary infarction		✓
Thrombosis of lower extremities Suspected dissecting aneurysm		✓
Uncontrolled asthma		✓
Pulmonary oedema		✓
Acute respiratory failure		✓
Acute non-cardiopulmonary disorder that may affect exercise performance or be aggravated by exercise (i.e. infection, renal failure, thyrotoxicosis)		✓
Mental impairment leading to inability to cooperate		✓
Physical impairment		✓
Diabetes		✓

Relative Contraindications:	Yes	No
Left main coronary stenosis or its equivalent		✓
Moderate stenotic valvular heart disease		✓
Severe untreated arterial hypertension at rest		✓
Tachyarrhythmias or bradyarrhythmia's		✓
High-degree atrioventricular block		✓
Hypertrophic cardiomyopathy		✓
Significant pulmonary hypertension		✓
Electrolyte abnormalities		✓
Orthopedic impairment that prevents walking		✓

Shuttle Walk Test Recording Form

Unit:

Designation:

Date: 23/01/21

ID: /

First name: [redacted]

Last name:

D.O.B. (dd/mm/yyyy) 2005 - 15yrs

Diatnosis: Scoliosis

Medication taken today	Dose	How many hours prior to testing?
/	/	/

Supplemental oxygen: ~~yes~~/no
Flow rate:
Device:
Method carried:

Walking aid: ~~yes~~/ no (specify)

	Level:	1	2	3	4	5	6	7	8	9	10	11	12
ISWT	1	3	4	5	6	7	8	9	10	11	1	0	0
	2	3	4	5	6	7	8	9	10	11	3	0	0

		ISWT1	ISWT2			ESWT1	ESWT2
				Date/ Time:			
Date/ Time:	23/01/21			Speed/ level:			
Start	Dyspnoea	0	0	Start	Dyspnoea		
	HR	88	89		HR		
	SpO_2	99%	99%		SpO_2		
Distance (m):		640	660	Time (seconds):			
End	Dyspnoea	3	2	End	Dyspnoea		
	Exertion	9	9		Exertion		
	HR	134	135		HR		
	SpO_2	97%	97%		SpO_2		
Recovery	Dyspnoea	0	0	Recovery	Dyspnoea		
	Exertion	/	/		Exertion		
	HR	89	89		HR		
	SpO_2	99%	99%		SpO_2		
Reason for termination		Did not reach target		Reason for termination:			

~~ESWT Tabulation~~

Peak VO_2 20.19 20.69

Comments:
Height - 1.63
Weight - 52
Cobb angle - 43°

Print:

Signature: S. Zammit

Page 10

11. Nifhem ukoll li l-kontribuzzjoni tat-tifel/tifla tiegħi ser isservi biex' ngħin biex ikollna aktar għarfien dwar il-kapaċità funzjonali tal-adolexxenti bi scoliosi idjopatika.
12. Nifhem ukoll, li skont ir-Regolamenti Ġenerali dwar il-Protezzjoni tad-Data (GDPR) u l-leġiżlazzjoni nazzjonali li timplimenta u tispeċifika aktar il-provvedimenti relevanti tar-regolamenti msemmija, jiena għandi d-dritt li naċċessa, nirretifika, u fejn japplika nitlob sabiex tithassar id-data li tikkonċernani.
13. Naf ukoll li meta jintemm l-istudju u r-riżultati jkunu ppubblikati, l-informazzjoni personali miġbura tithassar.
14. Fl-aħħar nett, naf ukoll li se ningħata kopja tal-ittra ta' informazzjoni u tal-formula ta' kunsens sabiex inkun nista' naċċessahom fil-futur.
15. Jien qrajt u fhimt il-punti u d-dikjarazzjonijiet f'din il-formula. Inħossni sodisfatt/a bit-tweġibiet li nghatajt għall-mistoqsijiet li kelli, u qed naċċetta minn jeddi li nipparteċipa f'dan l-istudju.

Parteċipant: [redacted]

Firma: _____

Data: 22/1/2021

Mireille Vincenti :

physiomv@outlook.com

Sebastian Zammit:

sebastian.zammit.17@um.edu.mt

Firma: _____

Data: _____

Firma: _____

Data: _____

audio recording' ser tiġi protetta minn '*password*' u meqruda meta jispiċċa l-istudju.

Għalhekk qed nagħti l-kunsens tiegħi lill-persuna responsabbli għal din ir-riċerka biex tagħmel l-osservazzjonijiet li hemm bżonn fuq it-tifel/ tifla tiegħi.

Naf li ma għandi l-ebda dmir nagħmel dan, u li nista' nirtira fi kwalunkwe punt, mingħajr ma nagħti raġuni.

Isem tal-parteċipant: [redacted]

Firma: M.S

Isem tal-ġenitur/gwardjan: [redacted]

Numru tat-telefon: [redacted]

Firma: Chiara Saliba

Isem tal-persuna responsabbli għall-istudju:

Sebastian Zammit

Firma:

S. Zammit

Exclusion Criteria

Absolute Contraindications:	Yes	No
Acute Myocardial Infarction (3-5 days)		✓
Unstable angina		✓
Uncontrolled arrhythmias causing symptoms or haemodynamic compromise		✓
Syncope		✓
Active endocarditis		✓
Acute myocarditis or pericarditis		✓
Symptomatic severe aortic stenosis		✓
Uncontrolled heart failure		✓
Acute pulmonary embolus or pulmonary infarction		✓
Thrombosis of lower extremities Suspected dissecting aneurysm		✓
Uncontrolled asthma		✓
Pulmonary oedema		✓
Acute respiratory failure		✓
Acute non-cardiopulmonary disorder that may affect exercise performance or be aggravated by exercise (i.e. infection, renal failure, thyrotoxicosis)		✓
Mental impairment leading to inability to cooperate		✓
Physical impairment		✓
Diabetes		✓

Relative Contraindications:	Yes	No
Left main coronary stenosis or its equivalent		✓
Moderate stenotic valvular heart disease		✓
Severe untreated arterial hypertension at rest		✓
Tachyarrhythmias or bradyarrhythmia's		✓
High-degree atrioventricular block		✓
Hypertrophic cardiomyopathy		✓
Significant pulmonary hypertension		✓
Electrolyte abnormalities		✓
Orthopedic impairment that prevents walking		✓

Shuttle Walk Test Recording Form

Unit:

Designation:

Date: 23/01/21

ID: /

First name: [redacted]

Last name:

D.O.B. (dd/mm/yyyy) 2004 - 16yrs

Diagnosis: Scoliosis

Medication taken today	Dose	How many hours prior to testing?
/	/	/

Supplemental oxygen: yes/no
Flow rate:
Device:
Method carried:

Walking aid: yes/ no (specify)

Level:		1	2	3	4	5	6	7	8	9	10	11	12
ISWT	1	3	4	5	6	7	8	9	10	10	0	0	0
	2	3	4	5	6	7	8	9	10	11	1	0	0

		ISWT1	ISWT2			ESWT1	ESWT2
				Date/ Time:			
Date/ Time:		23/01/21		Speed/ level:			
Start	Dyspnoea	0	0	Start	Dyspnoea		
	HR	72	72		HR		
	SpO_2	98%	98%		SpO_2		
Distance (m):		620	640	Time (seconds):			
End	Dyspnoea	2	3	End	Dyspnoea		
	Exertion	9	11		Exertion		
	HR	130	132		HR		
	SpO_2	95%	94%		SpO_2		
Recovery	Dyspnoea	0	0	Recovery	Dyspnoea		
	Exertion	/	/		Exertion		
	HR	72	73		HR		
	SpO_2	98%	98%		SpO_2		
Reason for termination		Did not reach target		Reason for termination:			

~~ESWT Calculation~~

Peak VO_2 19.69 20.19

Comments:
Height - 1.67
Weight - 50
Cobb angle - 25°

Print:

Signature: S. Zammit

Page 10

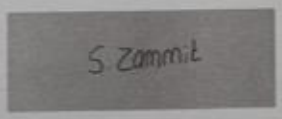
regulation, I have the right to access, rectify, and where applicable ask for the data concerning me to be erased.

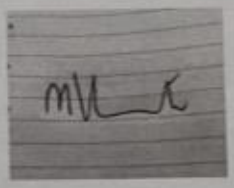
13. I also understand that once the study is completed and results are published the data will be retained in anonymous form. Any personal details of my child will be destroyed.
14. I will be provided with a copy of the information letter and consent form for future reference.
15. I have read and understood the points and statements of this form. I have had all the questions answered to my satisfaction, and I agree to participate in this study.

Participant: [redacted]

Signature: _____

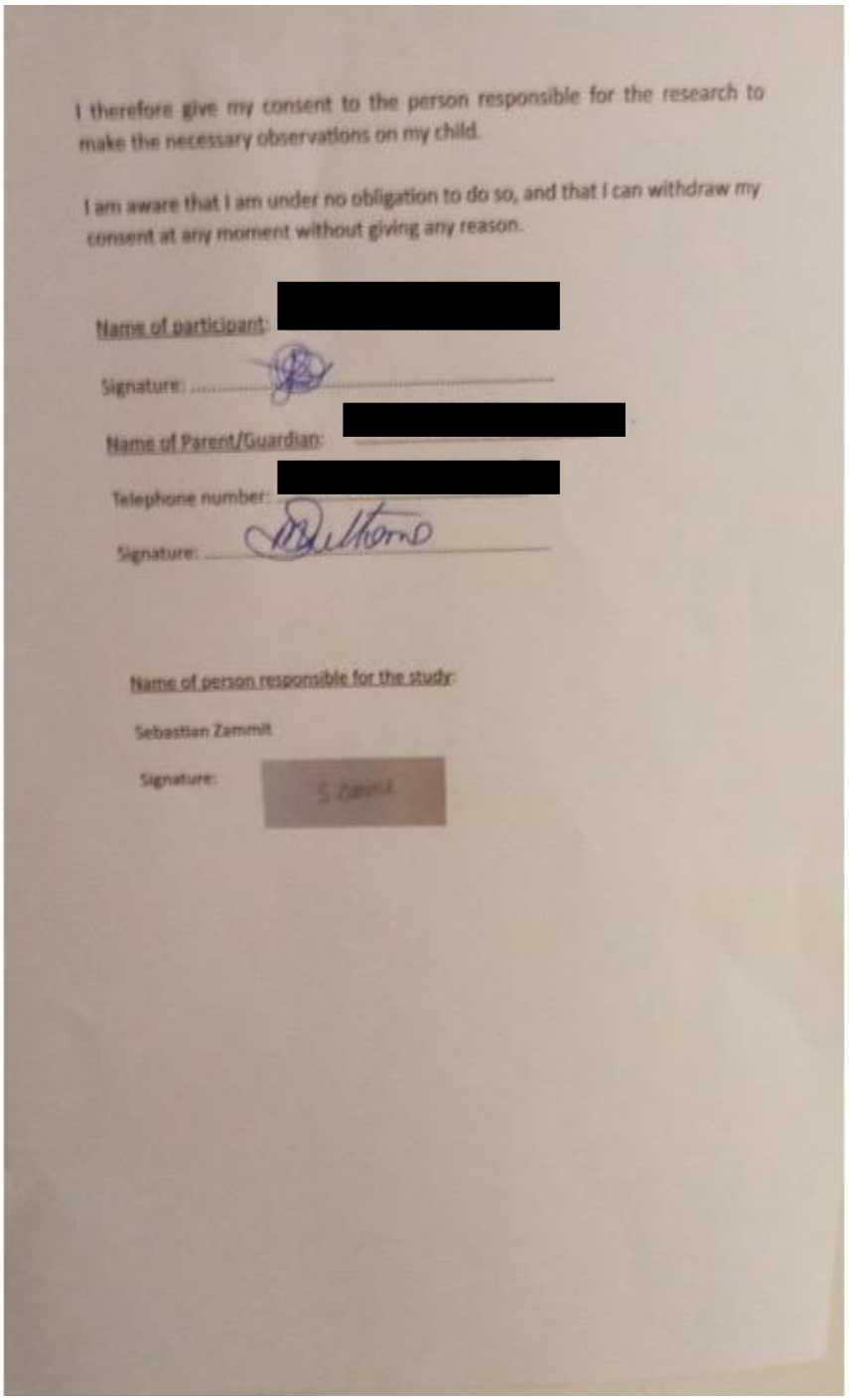
Date: 23rd January 2021





Sebastian Zammit
Researcher
+35699676745

Mireille Vincenti
Research Supervisor



I therefore give my consent to the person responsible for the research to make the necessary observations on my child.

I am aware that I am under no obligation to do so, and that I can withdraw my consent at any moment without giving any reason.

Name of participant: [redacted]

Signature: .....

Name of Parent/Guardian: [redacted]

Telephone number: [redacted]

Signature: .....

Name of person responsible for the study:

Sebastian Zammit

Signature:

Exclusion Criteria

Absolute Contraindications:	Yes	No
Acute Myocardial Infarction (3-5 days)		✓
Unstable angina		✓
Uncontrolled arrhythmias causing symptoms or haemodynamic compromise		✓
Syncope		✓
Active endocarditis		✓
Acute myocarditis or pericarditis		✓
Symptomatic severe aortic stenosis		✓
Uncontrolled heart failure		✓
Acute pulmonary embolus or pulmonary infarction		✓
Thrombosis of lower extremities Suspected dissecting aneurysm		✓
Uncontrolled asthma		✓
Pulmonary oedema		✓
Acute respiratory failure		✓
Acute non-cardiopulmonary disorder that may affect exercise performance or be aggravated by exercise (i.e. infection, renal failure, thyrotoxicosis)		✓
Mental impairment leading to inability to cooperate		✓
Physical impairment		✓
Diabetes		✓

Relative Contraindications:	Yes	No
Left main coronary stenosis or its equivalent		✓
Moderate stenotic valvular heart disease		✓
Severe untreated arterial hypertension at rest		✓
Tachyarrhythmias or bradyarrhythmia's		✓
High-degree atrioventricular block		✓
Hypertrophic cardiomyopathy		✓
Significant pulmonary hypertension		✓
Electrolyte abnormalities		✓
Orthopedic impairment that prevents walking		✓

Shuttle Walk Test Recording Form

Unit:

Designation:

Date: 30/01/21

ID: /

First name: [redacted]

Last name:

D.O.B. (dd/mm/yyyy) 2008 - 13 yrs

Diagnosis: Scoliosis

Medication taken today	Dose	How many hours prior to testing?

Supplemental oxygen: ~~yes~~/no
Flow rate:
Device:
Method carried:

Walking aid: ~~yes~~/ no (specify)

Level:		1	2	3	4	5	6	7	8	9	10	11	12
ISWT	1	3	4	5	6	7	8	5	0	0	0	0	0
	2	3	4	5	6	7	8	6	0	0	0	0	0

		ISWT1	ISWT2			ESWT1	ESWT2
				Date/ Time:			
Date/ Time:		30/01/21		Speed/ level:			
Start	Dyspnoea	0	0	Start	Dyspnoea		
	HR	84	85		HR		
	SpO_2	98%	98%		SpO_2		
Distance (m):		380	390	Time (seconds):			
End	Dyspnoea	2	3	End	Dyspnoea		
	Exertion	9	11		Exertion		
	HR	153	156		HR		
	SpO_2	95%	95%		SpO_2		
Recovery	Dyspnoea	0	0	Recovery	Dyspnoea		
	Exertion	/	/		Exertion		
	HR	86	86		HR		
	SpO_2	99%	98%		SpO_2		
Reason for termination		Did not reach target		Reason for termination:			

~~Estimated~~ Peak VO_2 13.69 13.94

Comments:
Height - 1.47
Weight - 37
Cobb angle - 19

Print:

Signature: S-Zammit

Page 10

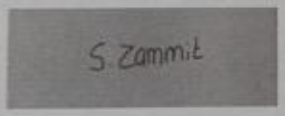
regulation, I have the right to access, rectify, and where applicable ask for the data concerning me to be erased.

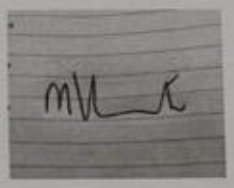
13. I also understand that once the study is completed and results are published the data will be retained in anonymous form. Any personal details of my child will be destroyed.
14. I will be provided with a copy of the information letter and consent form for future reference.
15. I have read and understood the points and statements of this form. I have had all the questions answered to my satisfaction, and I agree to participate in this study.

Participant: _____

Signature: [redacted]

Date: 30/1/2021





Sebastian Zammit
Researcher
+35699676745

Mireille Vincenti
Research Supervisor

I therefore give my consent to the person responsible for the research to make the necessary observations on my child.

I am aware that I am under no obligation to do so, and that I can withdraw my consent at any moment without giving any reason.

Name of participant: [redacted]

Signature: .....

Name of Parent/Guardian: [redacted]

Telephone number: [redacted]

Signature: .....

Name of person responsible for the study:

Sebastian Zammit

Signature: S Zammit

Exclusion Criteria

Absolute Contraindications:	Yes	No
Acute Myocardial Infarction (3-5 days)		✓
Unstable angina		✓
Uncontrolled arrhythmias causing symptoms or haemodynamic compromise		✓
Syncope		✓
Active endocarditis		✓
Acute myocarditis or pericarditis		✓
Symptomatic severe aortic stenosis		✓
Uncontrolled heart failure		✓
Acute pulmonary embolus or pulmonary infarction		✓
Thrombosis of lower extremities Suspected dissecting aneurysm		✓
Uncontrolled asthma		✓
Pulmonary oedema		✓
Acute respiratory failure		✓
Acute non-cardiopulmonary disorder that may affect exercise performance or be aggravated by exercise (i.e. infection, renal failure, thyrotoxicosis)		✓
Mental impairment leading to inability to cooperate		✓
Physical impairment		✓
Diabetes		✓

Relative Contraindications:	Yes	No
Left main coronary stenosis or its equivalent		✓
Moderate stenotic valvular heart disease		✓
Severe untreated arterial hypertension at rest		✓
Tachyarrhythmias or bradyarrhythmia's		✓
High-degree atrioventricular block		✓
Hypertrophic cardiomyopathy		✓
Significant pulmonary hypertension		✓
Electrolyte abnormalities		✓
Orthopedic impairment that prevents walking		✓

Shuttle Walk Test Recording Form

Unit:

Designation:

Date: 30/01/21

ID: /

First name: [redacted]

Last name:

D.O.B. (dd/mm/yyyy) 2005 - 16yrs

Diagnosis: Scoliosis

Medication taken today	Dose	How many hours prior to testing?

Supplemental oxygen: ~~yes~~/no
Flow rate:
Device:
Method carried:

Walking aid: ~~yes~~/ no (specify)

	Level:	1	2	3	4	5	6	7	8	9	10	11	12
ISWT	1	3	4	5	6	7	8	9	10	1	0	0	0
	2	3	4	5	6	7	8	9	10	3	0	0	0

		ISWT1	ISWT2			ESWT1	ESWT2
				Date/ Time:			
Date/ Time:		30/01/21		Speed/ level:			
Start	Dyspnoea	0	0	Start	Dyspnoea		
	HR	73	76		HR		
	SpO_2	99%	99%		SpO_2		
Distance (m):		530	550	Time (seconds):			
End	Dyspnoea	3	3	End	Dyspnoea		
	Exertion	11	11		Exertion		
	HR	145	147		HR		
	SpO_2	96%	95%		SpO_2		
Recovery	Dyspnoea	0	0	Recovery	Dyspnoea		
	Exertion	/	/		Exertion		
	HR	76	76		HR		
	SpO_2	99%	99%		SpO_2		
Reason for termination		Did not reach target		Reason for termination:			

~~EARLY TERMINATION~~

Peak VO_2 17.44 17.94

Comments:
Height - 1.67
Weight - 49
Cobb angle - 13

Print:

Signature: S. Zammit

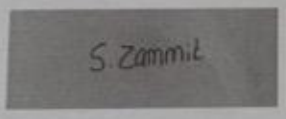
regulation, I have the right to access, rectify, and where applicable ask for the data concerning me to be erased.

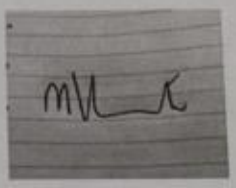
13. I also understand that once the study is completed and results are published the data will be retained in anonymous form. Any personal details of my child will be destroyed.
14. I will be provided with a copy of the information letter and consent form for future reference.
15. I have read and understood the points and statements of this form. I have had all the questions answered to my satisfaction, and I agree to participate in this study.

Participant: [redacted]

Signature: P Scerri

Date: 30/01/2021





Sebastian Zammit
Researcher
+35699676745

Mireille Vincenti
Research Supervisor

I therefore give my consent to the person responsible for the research to make the necessary observations on my child.

I am aware that I am under no obligation to do so, and that I can withdraw my consent at any moment without giving any reason.

Name of participant: [redacted]

Signature: .....

Name of Parent/Guardian: [redacted]

Telephone number: [redacted]

Signature: .....

Name of person responsible for the study:

Sebastian Zammit

Signature: S Zammit

Exclusion Criteria

Absolute Contraindications:	Yes	No
Acute Myocardial Infarction (3-5 days)		✓
Unstable angina		✓
Uncontrolled arrhythmias causing symptoms or haemodynamic compromise		✓
Syncope		✓
Active endocarditis		✓
Acute myocarditis or pericarditis		✓
Symptomatic severe aortic stenosis		✓
Uncontrolled heart failure		✓
Acute pulmonary embolus or pulmonary infarction		✓
Thrombosis of lower extremities Suspected dissecting aneurysm		✓
Uncontrolled asthma		✓
Pulmonary oedema		✓
Acute respiratory failure		✓
Acute non-cardiopulmonary disorder that may affect exercise performance or be aggravated by exercise (i.e. infection, renal failure, thyrotoxicosis)		✓
Mental impairment leading to inability to cooperate		✓
Physical impairment		✓
Diabetes		✓

Relative Contraindications:	Yes	No
Left main coronary stenosis or its equivalent		✓
Moderate stenotic valvular heart disease		✓
Severe untreated arterial hypertension at rest		✓
Tachyarrhythmias or bradyarrhythmia's		✓
High-degree atrioventricular block		✓
Hypertrophic cardiomyopathy		✓
Significant pulmonary hypertension		✓
Electrolyte abnormalities		✓
Orthopedic impairment that prevents walking		✓

Shuttle Walk Test Recording Form

Unit:

Designation:

Date: 05/02/21

ID: /

First name: [redacted]

Last name:

D.O.B. (dd/mm/yyyy) 2004-16

Diagnosis: Scoliosis

Medication taken today	Dose	How many hours prior to testing?

Supplemental oxygen: ~~yes~~/no
Flow rate:
Device:
Method carried:

Walking aid: ~~yes~~/ no (specify)

Level:		1	2	3	4	5	6	7	8	9	10	11	12
ISWT	1	3	4	5	6	7	8	9	1	0	0	0	0
	2	3	4	5	6	7	8	9	2	0	0	0	0

		ISWT1	ISWT2			ESWT1	ESWT2
				Date/ Time:			
Date/ Time:		05/02/21		Speed/ level:			
Start	Dyspnoea	0	0	Start	Dyspnoea		
	HR	81	80		HR		
	SpO_2	99%	99%		SpO_2		
Distance (m):		430	440	Time (seconds):			
End	Dyspnoea	1	1	End	Dyspnoea		
	Exertion	9	9		Exertion		
	HR	116	120		HR		
	SpO_2	97%	97%		SpO_2		
Recovery	Dyspnoea	0	0	Recovery	Dyspnoea		
	Exertion	/	/		Exertion		
	HR	82	81		HR		
	SpO_2	99%	99%		SpO_2		
Reason for termination		Did not reach target		Reason for termination:			

~~ESWT Cancelled~~

Peak VO_2 14.94 15.19

Comments:
Height - 1.58
Weight - 49
Cobb angle - 25°

Print:

Signature: S Zammit

Page 10

11. Nifhem ukoll li l-kontribuzzjoni tat-tifel/tifla tieghi ser isservi biex' nghin biex ikollna aktar gharfien dwar il-kapaċità funzjonali tal-adolexxenti bi scoliosi idjopatika.
12. Nifhem ukoll, li skont ir-Regolamenti Generali dwar il-Protezzjoni tad-Data (GDPR) u l-leġiżlazzjoni nazzjonali li timplimenta u tispeċifika aktar il-provvedimenti relevanti tar-regolamenti msemmija, jiena għandi d-dritt li naċċessa, nirretifika, u fejn japplika nitlob sabiex tithassar id-data li tikkonċernani.
13. Naf ukoll li meta jintemm l-istudju u r-riżultati jkunu ppubblikati, l-informazzjoni personali miġbura tithassar.
14. Fl-aħħar nett, naf ukoll li se ninghata kopja tal-ittra ta' informazzjoni u tal-formula ta' kunsens sabiex inkun nista' naċċessahom fil-futur.
15. Jien qrajt u fhimt il-punti u d-dikjarazzjonijiet f'din il-formula. Inhossni sodisfatt/a bit-tweġibiet li nghatajt għall-mistoqsijiet li kelli, u qed naċċetta minn jeddi li nipparteċipa f'dan l-istudju.

Parteċipant: [redacted]

Firma: Amy Zammit

Data: 05/02/21

Mireille Vincenti :

physiomv@outlook.com

Firma: [redacted]

Data: _____

Sebastian Zammit:

sebastian.zammit.17@um.edu.mt

Firma: [redacted]

Data: _____

audio recording ser tiġi protetta minn *password* u meqruda meta jispiċċa l-istudju.

Għalhekk qed nagħti l-kunsens tiegħi lill-persuna responsabbli għal din ir-riċerka biex tagħmel l-osservazzjonijiet li hemm bżonn fuq it-tifel/ tifla tiegħi.

Naf li ma għandi l-ebda dmir nagħmel dan, u li nista' nirtira fi kwalunkwe punt, minghajr ma nagħti raġuni.

Isem tal-parteċipant: [redacted]

Firma: Amy Zammit

Isem tal-ġenitur/gwardjan: [redacted]

Numru tat-telefon: [redacted]

Firma: Rosita Zammit

Isem tal-persuna responsabbli għall-istudju:

Sebastian Zammit

Firma:

S Zammit

Exclusion Criteria

Absolute Contraindications:	Yes	No
Acute Myocardial Infarction (3-5 days)		✓
Unstable angina		✓
Uncontrolled arrhythmias causing symptoms or haemodynamic compromise		✓
Syncope		✓
Active endocarditis		✓
Acute myocarditis or pericarditis		✓
Symptomatic severe aortic stenosis		✓
Uncontrolled heart failure		✓
Acute pulmonary embolus or pulmonary infarction		✓
Thrombosis of lower extremities Suspected dissecting aneurysm		✓
Uncontrolled asthma		✓
Pulmonary oedema		✓
Acute respiratory failure		✓
Acute non-cardiopulmonary disorder that may affect exercise performance or be aggravated by exercise (i.e. infection, renal failure, thyrotoxicosis)		✓
Mental impairment leading to inability to cooperate		✓
Physical impairment		✓
Diabetes		✓

Relative Contraindications:	Yes	No
Left main coronary stenosis or its equivalent		✓
Moderate stenotic valvular heart disease		✓
Severe untreated arterial hypertension at rest		✓
Tachyarrhythmias or bradyarrhythmia's		✓
High-degree atrioventricular block		✓
Hypertrophic cardiomyopathy		✓
Significant pulmonary hypertension		✓
Electrolyte abnormalities		✓
Orthopedic impairment that prevents walking		✓

Shuttle Walk Test Recording Form

Unit:

Designation:

Date: 06/02/21

ID: /

First name: [redacted]

Last name:

D.O.B. (dd/mm/yyyy) 2005-1543

Diagnosis: scoliosis

Medication taken today	Dose	How many hours prior to testing?

Supplemental oxygen: ~~yes~~/no
Flow rate:
Device:
Method carried:

Walking aid: ~~yes~~/ no (specify)

Level:		1	2	3	4	5	6	7	8	9	10	11	12
ISWT	1	3	4	5	6	7	8	9	0	0	0	0	0
	2	3	4	5	6	7	8	9	0	0	0	0	0

		ISWT1	ISWT2			ESWT1	ESWT2
Date/ Time:				Date/ Time:			
				Speed/ level:			
Start	Dyspnoea	0	0	Start	Dyspnoea		
	HR	87	90		HR		
	SpO_2	99%	99%		SpO_2		
Distance (m):		420	420	Time (seconds):			
End	Dyspnoea	3	3	End	Dyspnoea		
	Exertion	9	11		Exertion		
	HR	137	138		HR		
	SpO_2	97%	97%		SpO_2		
Recovery	Dyspnoea	0	0	Recovery	Dyspnoea		
	Exertion	/	/		Exertion		
	HR	91	91		HR		
	SpO_2	98%	98%		SpO_2		
Reason for termination		Did not reach target		Reason for termination:			

~~Estimated~~ Peak VO_2 14.69 14.69

Comments:
Height - 1.6
Weight - 37
Cobb angle - 27°

Print:

Signature: S. Tammit

11. Nifhem ukoll li l-kontribuzzjoni tat-tifel/tifla tiegħi ser isservi biex' ngħin biex ikollna aktar għarfien dwar il-kapaċità funzjonali tal-adolexxenti bi scoliosi idjopatika.
12. Nifhem ukoll, li skont ir-Regolamenti Ġenerali dwar il-Protezzjoni tad-Data (GDPR) u l-leġiżlazzjoni nazzjonali li timplimenta u tispecifika aktar il-provvedimenti relevanti tar-regolamenti msemmija, jiena għandi d-dritt li naċċessa, nirrettifika, u fejn japplika nitlob sabiex titħassar id-data li tikkonċernani.
13. Naf ukoll li meta jintemm l-istudju u r-riżultati jkunu ppubblikati, l-informazzjoni personali migbura titħassar.
14. Fl-aħħar nett, naf ukoll li se ningħata kopja tal-ittra ta' informazzjoni u tal-formula ta' kunsens sabiex inkun nista' naċċessahom fil-futur.
15. Jien qrajt u fhimt il-punti u d-dikjarazzjonijiet f'din il-formula. Inħossni sodisfatt/a bit-twegibiet li ngħatajt għall-mistoqsijiet li kelli, u qed naċċetta minn jeddi li nipparteċipa f'dan l-istudju.

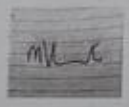
Parteċipant: [redacted]

Firma: Brooke

Data: 6/2/2021

Mireille Vincenti :

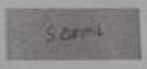
physiomv@outlook.com

Firma: 

Data: _____

Sebastian Zammit:

sebastian.zammit.17@um.edu.mt

Firma: 

Data: _____

audio recording ser tiġi protetta minn *password* u meqruda meta jispiċċa l-istudju.

Għalhekk qed nagħti l-kunsens tiegħi lill-persuna responsabbli għal din ir-ricerka biex tagħmel l-osservazzjonijiet li hemm bżonn fuq it-tifel/ tifla tiegħi.

Naf li ma għandi l-ebda dmir nagħmel dan; u li nista' nirtira fi kwalunkwe punt, mingħajr ma nagħti raġuni.

Isem tal-parteċipant: [redacted]

Firma: Brady

Isem tal-ġenitur/gwardjan: [redacted]

Numru tat-telefon: [redacted]

Firma: 2 - Biċċa

Isem tal-persuna responsabbli għall-istudju:

Sebastian Zammit

Firma:

S Zammit

Exclusion Criteria

Absolute Contraindications:	Yes	No
Acute Myocardial Infarction (3-5 days)		✓
Unstable angina		✓
Uncontrolled arrhythmias causing symptoms or haemodynamic compromise		✓
Syncope		✓
Active endocarditis		✓
Acute myocarditis or pericarditis		✓
Symptomatic severe aortic stenosis		✓
Uncontrolled heart failure		✓
Acute pulmonary embolus or pulmonary infarction		✓
Thrombosis of lower extremities Suspected dissecting aneurysm		✓
Uncontrolled asthma		✓
Pulmonary oedema		✓
Acute respiratory failure		✓
Acute non-cardiopulmonary disorder that may affect exercise performance or be aggravated by exercise (i.e. infection, renal failure, thyrotoxicosis)		✓
Mental impairment leading to inability to cooperate		✓
Physical impairment		✓
Diabetes		✓

Relative Contraindications:	Yes	No
Left main coronary stenosis or its equivalent		✓
Moderate stenotic valvular heart disease		✓
Severe untreated arterial hypertension at rest		✓
Tachyarrhythmias or bradyarrhythmia's		✓
High-degree atrioventricular block		✓
Hypertrophic cardiomyopathy		✓
Significant pulmonary hypertension		✓
Electrolyte abnormalities		✓
Orthopedic impairment that prevents walking		✓

Shuttle Walk Test Recording Form

Unit:

Designation:

Date: 06/02/21

ID: /

First name: [redacted]

Last name:

D.O.B. (dd/mm/yyyy) 2009 - 12yrs

Diagnosis: scoliosis

Medication taken today	Dose	How many hours prior to testing?

Supplemental oxygen: ~~yes~~/no
Flow rate:
Device:
Method carried:

Walking aid: ~~yes~~/ no (specify)

	Level:	1	2	3	4	5	6	7	8	9	10	11	12
ISWT	1	3	4	5	6	7	8	9	0	0	0	0	0
	2	3	4	5	6	7	8	9	3	0	0	0	0

		ISWT1	ISWT2			ESWT1	ESWT2
				Date/ Time:			
Date/ Time:		06/02/21		Speed/ level:			
Start	Dyspnoea	0	0	Start	Dyspnoea		
	HR	106	108		HR		
	SpO_2	98%	98%		SpO_2		
Distance (m):		420	450	Time (seconds):			
End	Dyspnoea	1	1	End	Dyspnoea		
	Exertion	9	9		Exertion		
	HR	133	134		HR		
	SpO_2	96%	94%		SpO_2		
Recovery	Dyspnoea	0	0	Recovery	Dyspnoea		
	Exertion	/	/		Exertion		
	HR	106	105		HR		
	SpO_2	98%	98%		SpO_2		
Reason for termination		Did not reach target		Reason for termination:			

~~Exercise calculation~~

Peak VO_2 14.69 15.44

Comments:
Height - 1.51
Weight - 38
Cobb angle - 29°

Print:

Signature: S. Tammit

11. Nifhem ukoll li l-kontribuzzjoni tat-tifel/tifla tieghi ser isservi biex' nghin biex ikollna aktar gharfien dwar il-kapacità funzjonali tal-adolexxenti bi scoliosi idjopatika.
12. Nifhem ukoll, li skont ir-Regolamenti Generali dwar il-Protezzjoni tad-Data (GDPR) u l-legizlazzjoni nazzjonali li timplimenta u tispecifika aktar il-provvedimenti relevanti tar-regolamenti msemmija, jiena ghandi d-dritt li naccessa, nirretifika, u fejn japplika nitlob sabiex tithassar id-data li tikkoncernani.
13. Naf ukoll li meta jintemm l-istudju u r-rizultati jkunu ppubblikati, l-informazzjoni personali migbura tithassar.
14. Fl-ahhar nett, naf ukoll li se ninghata kopja tal-ittra ta' informazzjoni u tal-formula ta' kunsens sabiex inkun nista' naccessahom fil-futur.
15. Jien qrajt u fhimt il-punti u d-dikjarazzjonijiet f'din il-formula. Inhossni sodisfatt/a bit-twegibiet li nghatajt ghall-mistoqsijiet li kelli, u qed naccetta minn jeddi li nippartecipa f'dan l-istudju.

Partecipant: [redacted]

Firma: _____

Data: 6/2/21

Mireille Vincenti :

physiomv@outlook.com

Firma: _____

Data: _____

Sebastian Zammit:

sebastian.zammit.17@um.edu.mt

Firma: _____

Data: _____

audio recording ser tiġi protetta minn *'password'* u meqruda meta jispiċċa l-istudju.

Għalhekk qed nagħti l-kunsens tiegħi lill-persuna responsabbli għal din ir-riċerka biex tagħmel l-osservazzjonijiet li hemm bżonn fuq it-tifel/ tifla tiegħi.

Naf li ma għandi l-ebda dmir nagħmel dan, u li nista' nirtira fi kwalunkwe punt, minħajr ma nagħti raġuni.

Isem tal-parteċipant: [redacted]

Firma: .....

Isem tal-ġenitur/gwardjan: [redacted]

Numru tat-telefon: [redacted]

Firma: .....

Isem tal-persuna responsabbli għall-istudju:

Sebastian Zammit

Firma:

S Zammit

Exclusion Criteria

Absolute Contraindications:	Yes	No
Acute Myocardial Infarction (3-5 days)		✓
Unstable angina		✓
Uncontrolled arrhythmias causing symptoms or haemodynamic compromise		✓
Syncope		✓
Active endocarditis		✓
Acute myocarditis or pericarditis		✓
Symptomatic severe aortic stenosis		✓
Uncontrolled heart failure		✓
Acute pulmonary embolus or pulmonary infarction		✓
Thrombosis of lower extremities Suspected dissecting aneurysm		✓
Uncontrolled asthma		✓
Pulmonary oedema		✓
Acute respiratory failure		✓
Acute non-cardiopulmonary disorder that may affect exercise performance or be aggravated by exercise (i.e. infection, renal failure, thyrotoxicosis)		✓
Mental impairment leading to inability to cooperate		✓
Physical impairment		✓
Diabetes		✓

Relative Contraindications:	Yes	No
Left main coronary stenosis or its equivalent		✓
Moderate stenotic valvular heart disease		✓
Severe untreated arterial hypertension at rest		✓
Tachyarrhythmias or bradyarrhythmia's		✓
High-degree atrioventricular block		✓
Hypertrophic cardiomyopathy		✓
Significant pulmonary hypertension		✓
Electrolyte abnormalities		✓
Orthopedic impairment that prevents walking		✓

Shuttle Walk Test Recording Form

Unit:

Designation:

Date: 06/02/21

ID: ✓

First name: [redacted]

Last name: [redacted]

D.O.B. (dd/mm/yyyy) 2005 - 15yrs

Diagnosis: Scoliosis

Medication taken today	Dose	How many hours prior to testing?

Supplemental oxygen: ~~yes~~/no
Flow rate:
Device:
Method carried:

Walking aid: ~~yes~~/ no (specify)

	Level:	1	2	3	4	5	6	7	8	9	10	11	12
ISWT	1	3	4	5	6	7	8	9	10	3	0	0	0
	2	3	4	5	6	7	8	9	10	4	0	0	0

		ISWT1	ISWT2			ESWT1	ESWT2
				Date/ Time:			
Date/ Time:				Speed/ level:			
Start	Dyspnoea	0	0	Start	Dyspnoea		
	HR	73	73		HR		
	SpO_2	99%	99%		SpO_2		
Distance (m):		550	560	Time (seconds):			
End	Dyspnoea	1	1	End	Dyspnoea		
	Exertion	9	9		Exertion		
	HR	130	132		HR		
	SpO_2	96%	96%		SpO_2		
Recovery	Dyspnoea	0	0	Recovery	Dyspnoea		
	Exertion	/	/		Exertion		
	HR	73	72		HR		
	SpO_2	99%	99%		SpO_2		
Reason for termination		Did not reach target		Reason for termination:			

~~ESWT Calculator~~

Peak VO_2 17.94 18.19

Comments:
Height - 1.62
Weight - 51
Cobb angle - 32°

Print:

Signature: S. Tammit

11. Nifhem ukoll li l-kontribuzzjoni tat-tifel/tifla tiegħi ser isservi biex' ngħin biex ikollna aktar għarfien dwar il-kapaċità funzjonali tal-adolexxenti bi scoliosi idjopatika.
12. Nifhem ukoll, li skont ir-Regolamenti Ġenerali dwar il-Protezzjoni tad-Data (GDPR) u l-leġiżlazzjoni nazzjonali li timplimenta u tispeċifika aktar il-provvedimenti relevanti tar-regolamenti msemmija, jiena għandi d-dritt li naċċessa, nirretifika, u fejn japplika nitlob sabiex titħassar id-data li tikkonċernani.
13. Naf ukoll li meta jintemm l-istudju u r-riżultati jkunu ppubblikati, l-informazzjoni personali miġbura titħassar.
14. Fl-aħħar nett, naf ukoll li se ningħata kopja tal-ittra ta' informazzjoni u tal-formula ta' kunsens sabiex inkun nista' naċċessahom fil-futur.
15. Jien qrajt u fhimt il-punti u d-dikjarazzjonijiet f'din il-formula. Inħossni sodisfatt/a bit-tweġibiet li ngħatajt għall-mistoqsijiet li kelli, u qed naċċetta minn jeddi li nipparteċipa f'dan l-istudju.

Parteċipant: [redacted]

Firma: [redacted]

Data: 06/02/2021

Mireille Vincenti :

physiomv@outlook.com

Firma: [redacted]

Data: _____

Sebastian Zammit:

sebastian.zammit.17@um.edu.mt

Firma: [redacted]

Data: _____

audio recording' ser tiġi protetta minn '*password*' u meqruda meta jispiċċa l-istudju.

Għalhekk qed nagħti l-kunsens tiegħi lill-persuna responsabbli għal din ir-ricerka biex tagħmel l-osservazzjonijiet li hemm bżonn fuq it-tifel/ tifla tiegħi.

Naf li ma għandi l-ebda dmir nagħmel dan, u li nista' nirtira fi kwalunkwe punt, mingħajr ma nagħti raġuni.

Isem tal-parteċipant: [redacted]

Firma: [redacted]

Isem tal-ġenitur/gwardjan: [redacted]

Numru tat-telefon: [redacted]

Firma: [redacted]

Isem tal-persuna responsabbli għall-istudju:

Sebastian Zammit

Firma:

[redacted]

Exclusion Criteria

Absolute Contraindications:	Yes	No
Acute Myocardial Infarction (3-5 days)		✓
Unstable angina		✓
Uncontrolled arrhythmias causing symptoms or haemodynamic compromise		✓
Syncope		✓
Active endocarditis		✓
Acute myocarditis or pericarditis		✓
Symptomatic severe aortic stenosis		✓
Uncontrolled heart failure		✓
Acute pulmonary embolus or pulmonary infarction		✓
Thrombosis of lower extremities Suspected dissecting aneurysm		✓
Uncontrolled asthma		✓
Pulmonary oedema		✓
Acute respiratory failure		✓
Acute non-cardiopulmonary disorder that may affect exercise performance or be aggravated by exercise (i.e. infection, renal failure, thyrotoxicosis)		✓
Mental impairment leading to inability to cooperate		✓
Physical impairment		✓
Diabetes		✓

Relative Contraindications:	Yes	No
Left main coronary stenosis or its equivalent		✓
Moderate stenotic valvular heart disease		✓
Severe untreated arterial hypertension at rest		✓
Tachyarrhythmias or bradyarrhythmia's		✓
High-degree atrioventricular block		✓
Hypertrophic cardiomyopathy		✓
Significant pulmonary hypertension		✓
Electrolyte abnormalities		✓
Orthopedic impairment that prevents walking		✓

Shuttle Walk Test Recording Form

Unit:

Designation:

Date: 06/02/21

ID: /

First name: [redacted]

Last name: [redacted]

D.O.B. (dd/mm/yyyy) 2008-13yrs

Diagnosis: scoliosis

Medication taken today	Dose	How many hours prior to testing?

Supplemental oxygen: ~~yes~~/no
Flow rate:
Device:
Method carried:

Walking aid: ~~yes~~/ no (specify)

Level:		1	2	3	4	5	6	7	8	9	10	11	12
ISWT	1	3	4	5	6	7	8	9	3	0	0	0	0
	2	3	4	5	6	7	8	9	4	0	0	0	0

		ISWT1	ISWT2			ESWT1	ESWT2
				Date/ Time:			
Date/ Time:		06/02/21		Speed/ level:			
Start	Dyspnoea	0	0	Start	Dyspnoea		
	HR	72	70		HR		
	SpO_2	98%	98%		SpO_2		
Distance (m):		450	460	Time (seconds):			
End	Dyspnoea	1	1	End	Dyspnoea		
	Exertion	9	9		Exertion		
	HR	123	127		HR		
	SpO_2	94%	93%		SpO_2		
Recovery	Dyspnoea	0	0	Recovery	Dyspnoea		
	Exertion	/	/		Exertion		
	HR	70	71		HR		
	SpO_2	98%	98%		SpO_2		
Reason for termination		Did not reach target		Reason for termination:			

~~ESWT calculation~~

Peak VO_2 15.44 15.69

Comments:
Height - 1.62
Weight - 57
Cobb angle - 36°

Print:

Signature: S. Zammit

11. Nifhem ukoll li l-kontribuzzjoni tat-tifel/tifla tiegħi ser isservi biex' ngħin biex ikollna aktar għarfien dwar il-kapaċità funzjonali tal-adolexxenti bi scoliosi idjopatika.
12. Nifhem ukoll, li skont ir-Regolamenti Ġenerali dwar il-Protezzjoni tad-Data (GDPR) u l-leġiżlazzjoni nazzjonali li timplimenta u tispeċifika aktar il-provvedimenti relevanti tar-regolamenti msemmija, jiena għandi d-dritt li naċċessa, nirretifika, u fejn japplika nitlob sabiex tithassar id-data li tikkonċernani.
13. Naf ukoll li meta jintemm l-istudju u r-riżultati jkunu ppubblikati, l-informazzjoni personali miġbura tithassar.
14. Fl-aħħar nett, naf ukoll li se ningħata kopja tal-ittra ta' informazzjoni u tal-formula ta' kunsens sabiex inkun nista' naċċessahom fil-futur.
15. Jien qrajt u fhimt il-punti u d-dikjarazzjonijiet f'din il-formula. Inħossni sodisfatt/a bit-tweġibiet li ngħatajt għall-mistoqsijiet li kelli, u qed naċċetta minn jeddi li nipparteċipa f'dan l-istudju.

Parteċipant: [redacted]

Firma: K. Bonaro

Data: 6-2-21

Mireille Vincenti :

physiomv@outlook.com

Firma: MVK

Data: _____

Sebastian Zammit:

sebastian.zammit.17@um.edu.mt

Firma: S Zammit

Data: _____

audio recording ser tiġi protetta minn *password* u meqruda meta jispiċċa l-istudju.

Għalhekk qed nagħti l-kunsens tiegħi lill-persuna responsabbli għal din ir-riċerka biex tagħmel l-osservazzjonijiet li hemm bżonn fuq it-tifel/ tifla tiegħi.

Naf li ma għandi l-ebda dmir nagħmel dan, u li nista' nirtira fi kwalunkwe punt, mingħajr ma nagħti raġuni.

Isem tal-parteċipant: [redacted]

Firma: K Leonard

Isem tal-ġenitur/gwardjan: [redacted]

Numru tat-telefon: [redacted]

Firma: Leonard

Isem tal-persuna responsabbli għall-istudju:

Sebastian Zammit

Firma:

S Zammit

Exclusion Criteria

Absolute Contraindications:	Yes	No
Acute Myocardial Infarction (3-5 days)		✓
Unstable angina		✓
Uncontrolled arrhythmias causing symptoms or haemodynamic compromise		✓
Syncope		✓
Active endocarditis		✓
Acute myocarditis or pericarditis		✓
Symptomatic severe aortic stenosis		✓
Uncontrolled heart failure		✓
Acute pulmonary embolus or pulmonary infarction		✓
Thrombosis of lower extremities Suspected dissecting aneurysm		✓
Uncontrolled asthma		✓
Pulmonary oedema		✓
Acute respiratory failure		✓
Acute non-cardiopulmonary disorder that may affect exercise performance or be aggravated by exercise (i.e. infection, renal failure, thyrotoxicosis)		✓
Mental impairment leading to inability to cooperate		✓
Physical impairment		✓
Diabetes		✓

Relative Contraindications:	Yes	No
Left main coronary stenosis or its equivalent		✓
Moderate stenotic valvular heart disease		✓
Severe untreated arterial hypertension at rest		✓
Tachyarrhythmias or bradyarrhythmia's		✓
High-degree atrioventricular block		✓
Hypertrophic cardiomyopathy		✓
Significant pulmonary hypertension		✓
Electrolyte abnormalities		✓
Orthopedic impairment that prevents walking		✓

Appendix 5 - Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Participants	0				
Age	10	12	16	14.70	1.49
BMI	10	15	22	18.38	2.04
Cobb angle	10	13	43	28.10	8.48
Height	10	1	2	1.60	.07
Weight	10	37	57	47.20	7.18
SpO2 before 1st	10	98	99	98.50	.53
SpO2 after 1st	10	94	97	95.90	.99
SpO2 before 2nd	10	98	99	98.50	.53
SpO2 after 2nd	10	93.00	97.00	95.30	1.42
HR at rest 1st	10	72.00	106.00	81.80	10.56
HR on exertion 1st	10	116.00	153.00	133.80	10.42
HR at rest 2nd	10	70.00	108.00	82.70	11.36
HR on exertion 2nd	10	120.00	156.00	136.10	10.08
Max HR - bpm	10	204.00	208.00	205.30	1.49
Percentage HR 1st test	10	56.90	73.90	65.17	5.02
Percentage HR 2nd test	10	58.80	75.30	66.29	4.84
1st Borg scale at rest	10	0	0	.00	.00
1ST Borg scale on exertion	10	1.00	3.00	2.00	.94
2nd Borg scale at rest	10	0	0	.00	.00
Borg scale on exertion	10	1.00	3.00	2.10	.99
Distance 1st test	10	380.00	640.00	506	97.78
Distance 2nd test	10	390.00	660.00	522	102.83
1st RPE at rest	10	6	6	6.00	.00
1st RPE on exertion	10	9.00	11.00	9.20	.63
2nd RPE at rest	10	6	6	6.00	.00
2nd RPE on exertion	10	9.00	11.00	9.80	1.03
1st Peak VO2	10	13.69	20.19	16.84	2.44
2nd Peak VO2	10	13.94	20.69	17.24	2.57
Valid N (listwise)	0				

Statistical analysis

T-Test

Notes

Output Created		01-MAR-2021 14:53:24
Comments		
Input	Active Dataset	DataSet2
	Filter	<none>
	Weight	<none>
	Split File	<none>
	N of Rows in Working Data File	11
Missing Value Handling	Definition of Missing	User defined missing values are treated as missing.
	Cases Used	Statistics for each analysisare based on the cases with no missing or out-of- range data for any variablein the analysis.
Syntax		T-TEST /TESTVAL=18 /MISSING=ANALYSIS /VARIABLES=BMI /ES DISPLAY(TRUE) /CRITERIA=CI(.95).
Resources	Processor Time	00:00:00.03
	Elapsed Time	00:00:00.01

One-Sample Statistics

	N	Mean	Std. Deviation	Std. Error Mean
BMI	10	18.38	2.04	.644

One-Sample Test

Test Value = 18

	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
BMI	.59	9	.57	.380	-1.08	1.84

One-Sample Effect Sizes

		Standardizer[a]	Point Estimate	95% Confidence Interval	
				Lower	Upper
BMI	Cohen's d	2.036	.187	-.444	.807
	Hedges' correction	2.228	.171	-.406	.738

a. The denominator used in estimating the effect sizes.
Cohen's d uses the sample standard deviation.
Hedges' correction uses the sample standard deviation, plus a correction factor.

Explore

Notes

Output Created		24-FEB-2021 17:15:07
Comments		
Input	Active Dataset	DataSet2
	Filter	<none>
	Weight	<none>
	Split File	<none>
	N of Rows in Working Data File	10
Missing Value Handling	Definition of Missing	User-defined missing values for dependent variables are treated as missing.
	Cases Used	Statistics are based on cases with no missing values for any dependent variable or factor used.

Notes

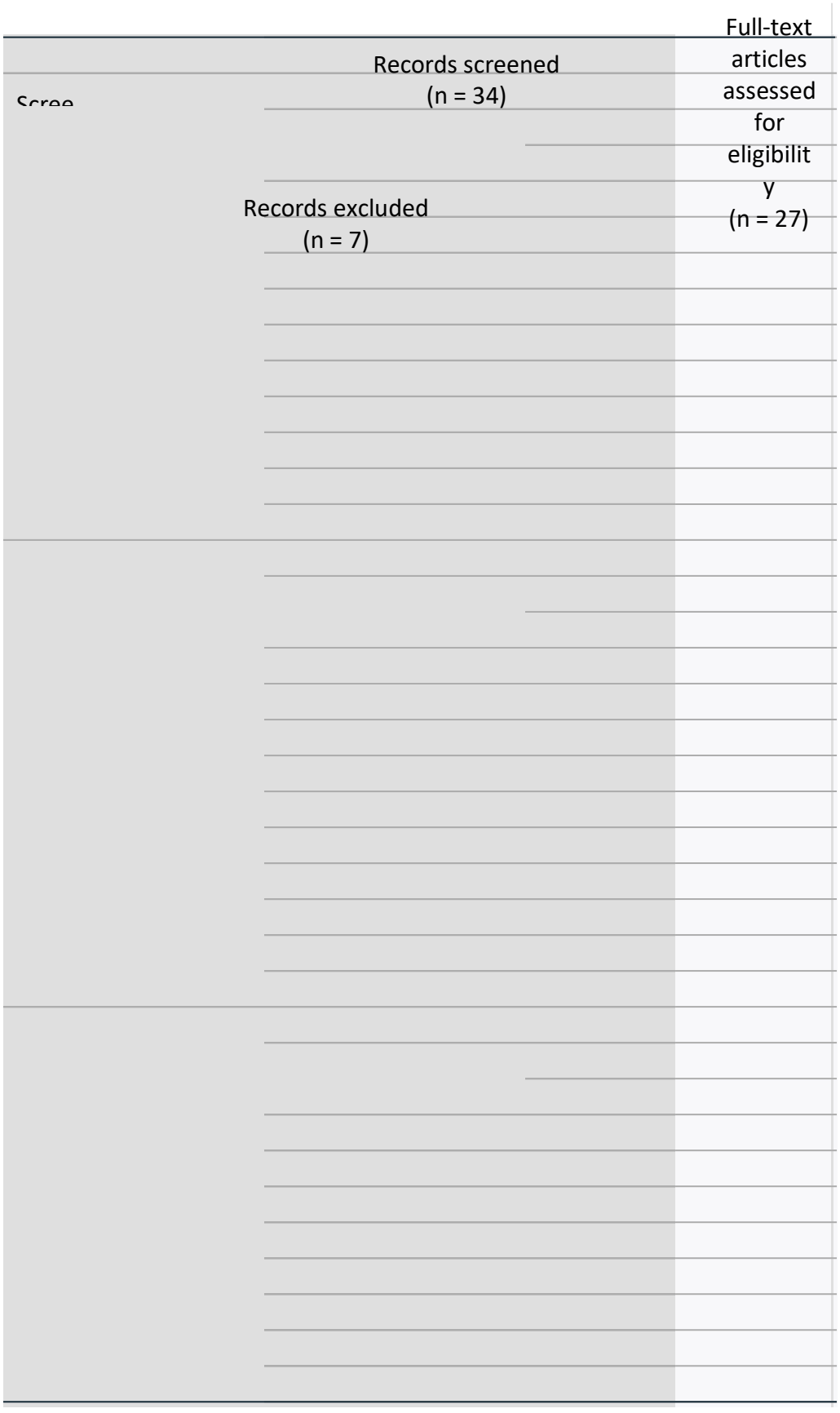
Syntax		EXAMINE VARIABLES=Age BMI Cobbangle Height Weight SpO2before1st SpO2after1st SpO2before2nd SpO2after2nd HRatrest1st HRonexertion1st HRatrest2nd HRonexertion2nd MaxHRbpm PercentageHR1sttest PercentageHR2ndtest @1stBorgscaleatrest @1STBorgscaleonexertion @2ndBorgscaleatrest Borgscaleonexertion Distance1sttest Distance2ndtest @1stRPEatrest @1stRPEonexertion @2ndRPEatrest @2ndRPEonexertion @1stPeakVO2 @2ndPeakVO2 /PLOT BOXPLOT NPPLOT /COMPARE GROUPS /STATISTICS DESCRIPTIVES /CINTERVAL 95 /MISSING LISTWISE /NOTOTAL.
Resources	Processor Time	00:00:16.94
	Elapsed Time	00:00:11.30

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Age	10	100.0%	0	0.0%	10	100.0%
BMI	10	100.0%	0	0.0%	10	100.0%
Cobb angle	10	100.0%	0	0.0%	10	100.0%
Height	10	100.0%	0	0.0%	10	100.0%
Weight	10	100.0%	0	0.0%	10	100.0%
SpO2 before 1st	10	100.0%	0	0.0%	10	100.0%
SpO2 after 1st	10	100.0%	0	0.0%	10	100.0%
SpO2 before 2nd	10	100.0%	0	0.0%	10	100.0%
SpO2 after 2nd	10	100.0%	0	0.0%	10	100.0%
HR at rest 1st	10	100.0%	0	0.0%	10	100.0%
HR on exertion 1st	10	100.0%	0	0.0%	10	100.0%
HR at rest 2nd	10	100.0%	0	0.0%	10	100.0%
HR on exertion 2nd	10	100.0%	0	0.0%	10	100.0%
Max HR - bpm	10	100.0%	0	0.0%	10	100.0%
Percentage HR 1st test	10	100.0%	0	0.0%	10	100.0%
Percentage HR 2nd test	10	100.0%	0	0.0%	10	100.0%
1st Borg scale at rest	10	100.0%	0	0.0%	10	100.0%
1ST Borg scale on exertion	10	100.0%	0	0.0%	10	100.0%
2nd Borg scale at rest	10	100.0%	0	0.0%	10	100.0%
Borg scale on exertion	10	100.0%	0	0.0%	10	100.0%
Distance 1st test	10	100.0%	0	0.0%	10	100.0%
Distance 2nd test	10	100.0%	0	0.0%	10	100.0%
1st RPE at rest	10	100.0%	0	0.0%	10	100.0%
1st RPE on exertion	10	100.0%	0	0.0%	10	100.0%
2nd RPE at rest	10	100.0%	0	0.0%	10	100.0%
2nd RPE on exertion	10	100.0%	0	0.0%	10	100.0%
1st Peak VO2	10	100.0%	0	0.0%	10	100.0%
2nd Peak VO2	10	100.0%	0	0.0%	10	100.0%

Re Identification	Records identified through database searching (Pubmed) (n = 75)	Records after duplicates removed (n = 34)

			Std. Error
Age	Mean		.47
	95% Confidence Interval for Mean	Lower Bound	
		Upper Bound	
	5% Trimmed Mean		
	Median		
	Variance		
	Std. Deviation		
	Minimum		
	Maximum		
	Range		
	Interquartile Range		
	Skewness		.687
	Kurtosis		1.334
BMI	Mean		.64
	95% Confidence Interval for Mean	Lower Bound	
		Upper Bound	
	5% Trimmed Mean		
	Median		
	Variance		
	Std. Deviation		
	Minimum		
	Maximum		
	Range		
	Interquartile Range		
	Skewness		.687
	Kurtosis		1.334
Cobb angle	Mean		2.6810
	95% Confidence Interval for Mean	Lower Bound	
		Upper Bound	
	5% Trimmed Mean		
	Median		
	Variance		
	Std. Deviation		
	Minimum		
	Maximum		
	Range		
	Interquartile Range		
	Skewness		.687


Scree
Records screened
(n = 34)
Records excluded
(n = 7)
Full-text
articles
assessed
for
eligibilit
y
(n = 27)

			Std. Error
	Kurtosis		1.33
Height	Mean		.02049
	95% Confidence Interval for Mean	Lower Bound	
		Upper Bound	
	5% Trimmed Mean		
	Median		
	Variance		
	Std. Deviation		
	Minimum		
	Maximum		
	Range		
	Interquartile Range		
	Skewness		.687
	Kurtosis		1.334
Weight	Mean		2.27
	95% Confidence Interval for Mean	Lower Bound	
		Upper Bound	
	5% Trimmed Mean		
	Median		
	Variance		
	Std. Deviation		
	Minimum		
	Maximum		
	Range		
	Interquartile Range		
	Skewness		.687
	Kurtosis		1.334
SpO2 before 1st	Mean		.17
	95% Confidence Interval for Mean	Lower Bound	
		Upper Bound	
	5% Trimmed Mean		
	Median		
	Variance		
	Std. Deviation		
	Minimum		
	Maximum		
	Range		
	Interquartile Range		

Eligibility

Full-text

Studies included
(n = 4)

Additional articles identified through reference list of identified studies (n = 39)

			Std. Error
	Skewness		.687
	Kurtosis		1.334
SpO2 after 1st	Mean		.31
	95% Confidence Interval for Mean	Lower Bound	
		Upper Bound	
	5% Trimmed Mean		
	Median		
	Variance		
	Std. Deviation		
	Minimum		
	Maximum		
	Range		
	Interquartile Range		
	Skewness		.687
	Kurtosis		1.334
SpO2 before 2nd	Mean		.17
	95% Confidence Interval for Mean	Lower Bound	
		Upper Bound	
	5% Trimmed Mean		
	Median		
	Variance		
	Std. Deviation		
	Minimum		
	Maximum		
	Range		
	Interquartile Range		
	Skewness		.687
	Kurtosis		1.334
SpO2 after 2nd	Mean		.45
	95% Confidence Interval for Mean	Lower Bound	
		Upper Bound	
	5% Trimmed Mean		
	Median		
	Variance		
	Std. Deviation		
	Minimum		
	Maximum		
	Range		

Records identified through database searching (Pubmed) (n = 75)

(n = 4+39 = 43)

Included

Records excluded through filters:
2000 - 2020
Free full text available
Full texts available
Adolescent 10 -18
(n = 41)

			Std. Error
	Interquartile Range		
	Skewness		.687
	Kurtosis		1.334
HR at rest 1st	Mean		3.34
	95% Confidence Interval for Mean	Lower Bound	
		Upper Bound	
	5% Trimmed Mean		
	Median		
	Variance		
	Std. Deviation		
	Minimum		
	Maximum		
	Range		
	Interquartile Range		
	Skewness		.687
	Kurtosis		1.334
HR on exertion 1st	Mean		3.30
	95% Confidence Interval for Mean	Lower Bound	
		Upper Bound	
	5% Trimmed Mean		
	Median		
	Variance		
	Std. Deviation		
	Minimum		
	Maximum		
	Range		
	Interquartile Range		
	Skewness		.687
	Kurtosis		1.334
HR at rest 2nd	Mean		3.59
	95% Confidence Interval for Mean	Lower Bound	
		Upper Bound	
	5% Trimmed Mean		
	Median		
	Variance		
	Std. Deviation		
	Minimum		
	Maximum		

	Records after duplicates removed (n = 34)	Records screened (n = 34)
Identification		
Screening		

			Std. Error
	Range		
	Interquartile Range		
	Skewness		.687
	Kurtosis		1.334
HR on exertion 2nd	Mean		3.19
	95% Confidence Interval for Mean	Lower Bound	
		Upper Bound	
	5% Trimmed Mean		
	Median		
	Variance		
	Std. Deviation		
	Minimum		
	Maximum		
	Range		
	Interquartile Range		
	Skewness		.687
	Kurtosis		1.334
Max HR - bpm	Mean		.47
	95% Confidence Interval for Mean	Lower Bound	
		Upper Bound	
	5% Trimmed Mean		
	Median		
	Variance		
	Std. Deviation		
	Minimum		
	Maximum		
	Range		
	Interquartile Range		
	Skewness		.687
	Kurtosis		1.334
Percentage HR 1st test	Mean		1.59
	95% Confidence Interval for Mean	Lower Bound	
		Upper Bound	
	5% Trimmed Mean		
	Median		
	Variance		
	Std. Deviation		
	Minimum		

Eligibility

Full-text articles assessed for eligibility
(n = 27)

Records excluded

Full-text articles excluded, with reasons:
Adults
Articles older than 1970
(n = 23)

			Std. Error
	Maximum		
	Range		
	Interquartile Range		
	Skewness		.687
	Kurtosis		1.334
Percentage HR 2nd test	Mean		1.53
	95% Confidence Interval for Mean	Lower Bound	
		Upper Bound	
	5% Trimmed Mean		
	Median		
	Variance		
	Std. Deviation		
	Minimum		
	Maximum		
	Range		
	Interquartile Range		
	Skewness		.687
	Kurtosis		1.334
1st Borg scale at rest	Mean		.00
	95% Confidence Interval for Mean	Lower Bound	
		Upper Bound	
	5% Trimmed Mean		
	Median		
	Variance		
	Std. Deviation		
	Minimum		
	Maximum		
	Range		
	Interquartile Range		
	Skewness		.
	Kurtosis		.
1ST Borg scale on exertion	Mean		.30
	95% Confidence Interval for Mean	Lower Bound	
		Upper Bound	
	5% Trimmed Mean		
	Median		
	Variance		
	Std. Deviation		

		Studie
	Included	Age
Additional articles	(n = 4+39 = 43)	

			Std. Error
	Minimum		
	Maximum		
	Range		
	Interquartile Range		
	Skewness		.687
	Kurtosis		1.334
2nd Borg scale at rest	Mean		.00
	95% Confidence Interval for Mean	Lower Bound	
		Upper Bound	
	5% Trimmed Mean		
	Median		
	Variance		
	Std. Deviation		
	Minimum		
	Maximum		
	Range		
	Interquartile Range		
	Skewness		.
	Kurtosis		.
Borg scale on exertion	Mean		.31
	95% Confidence Interval for Mean	Lower Bound	
		Upper Bound	
	5% Trimmed Mean		
	Median		
	Variance		
	Std. Deviation		
	Minimum		
	Maximum		
	Range		
	Interquartile Range		
	Skewness		.687
	Kurtosis		1.334
Distance 1st test	Mean		30.92
	95% Confidence Interval for Mean	Lower Bound	
		Upper Bound	
	5% Trimmed Mean		
	Median		
	Variance		

			Height
		5	
		%	
		T	
		r	
		i	
		m	
		m	
Mean		e	
		d	
		M	
Statistic			
		14.70	
		13.63	
		15.77	
		14.78	
		15.00	
		2.23	
		1.49	
		12.00	
		16.00	
		4.00	
		3.00	
		-.86	
		-.78	
		18.38	
		16.92	
		19.84	
		18.41	
		18.70	
		4.15	
		2.04	
		14.50	
		21.70	
		7.20	
		2.70	
		-.37	
		.34	
		28.10	

			Std. Error
	Std. Deviation		
	Minimum		
	Maximum		
	Range		
	Interquartile Range		
	Skewness		.687
	Kurtosis		1.334
Distance 2nd test	Mean		32.52
	95% Confidence Interval for Mean	Lower Bound	
		Upper Bound	
	5% Trimmed Mean		
	Median		
	Variance		
	Std. Deviation		
	Minimum		
	Maximum		
	Range		
	Interquartile Range		
	Skewness		.687
	Kurtosis		1.334
1st RPE at rest	Mean		.00
	95% Confidence Interval for Mean	Lower Bound	
		Upper Bound	
	5% Trimmed Mean		
	Median		
	Variance		
	Std. Deviation		
	Minimum		
	Maximum		
	Range		
	Interquartile Range		
	Skewness		.
	Kurtosis		.
1st RPE on exertion	Mean		.20
	95% Confidence Interval for Mean	Lower Bound	
		Upper Bound	
	5% Trimmed Mean		
	Median		

			SpO2 after 1st
		5	
		%	
		T	
		r	
		i	
		m	
		m	
		e	
K		d	
		M	
		e	
Statistic			
		.421	
		1.60	
		1.55	
		1.65	
		1.60	
		1.62	
		.00	
		.065	
		1.47	
		1.67	
		.20	
		.08	
		-1.11	
		.63	
		47.20	
		42.07	
		52.33	
		47.22	
		49.50	
		51.51	
		7.18	
		37.00	
		57.00	
		20.00	
		14.30	
		-.62	

			Std. Error
	Variance		
	Std. Deviation		
	Minimum		
	Maximum		
	Range		
	Interquartile Range		
	Skewness		.687
	Kurtosis		1.334
2nd RPE at rest	Mean		.00
	95% Confidence Interval forMean	Lower Bound	
		Upper Bound	
	5% Trimmed Mean		
	Median		
	Variance		
	Std. Deviation		
	Minimum		
	Maximum		
	Range		
	Interquartile Range		
	Skewness		.
	Kurtosis		.
2nd RPE on exertion	Mean		.33
	95% Confidence Interval forMean	Lower Bound	
		Upper Bound	
	5% Trimmed Mean		
	Median		
	Variance		
	Std. Deviation		
	Minimum		
	Maximum		
	Range		
	Interquartile Range		
	Skewness		.687
	Kurtosis		1.334
1st Peak VO2	Mean		.77
	95% Confidence Interval forMean	Lower Bound	
		Upper Bound	

	5% Trimmed Mean	

			Statistic
		5	.00
		%	-2.57
		T	95.90
		r	95.19
		i	96.61
		m	95.94
		m	96.00
		e	.99
		d	.99
S		M	94.00
		e	97.00
		a	3.00
		n	2.00
		M	-.61
		e	-.16
		d	98.50
		i	98.12
		a	98.88
		n	98.50
		Variance	98.50
		S	.28
		t	.53

			Std. Error
	Median		
	Variance		
	Std. Deviation		
	Minimum		
	Maximum		
	Range		
	Interquartile Range		
	Skewness		.687
	Kurtosis		1.334
2nd Peak VO2	Mean		.81
	95% Confidence Interval for Mean	Lower Bound	
		Upper Bound	
	5% Trimmed Mean		
	Median		
	Variance		
	Std. Deviation		
	Minimum		
	Maximum		
	Range		
	Interquartile Range		
	Skewness		.687
	Kurtosis		1.334

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Age	.28	10	.03	.86	10	.02
BMI	.19	10	.20*	.96	10	.75
Cobb angle	.16	10	.20*	.99	10	.99
Height	.22	10	.18	.87	10	.11
Weight	.30	10	.01	.84	10	.04
SpO2 before 1st	.33	10	.00	.66	10	.00
SpO2 after 1st	.24	10	.11	.89	10	.15
SpO2 before 2nd	.33	10	.00	.66	10	.00
SpO2 after 2nd	.19	10	.20*	.91	10	.25
HR at rest 1st	.20	10	.20*	.85	10	.05
HR on exertion 1st	.18	10	.20*	.97	10	.93
HR at rest 2nd	.16	10	.20*	.90	10	.24
HR on exertion 2nd	.15	10	.20*	.97	10	.85
Max HR - bpm	.28	10	.03	.82	10	.02
Percentage HR 1st test	.16	10	.20*	.97	10	.92
Percentage HR 2nd test	.15	10	.20*	.97	10	.87
1st Borg scale at rest	.	10	.	.	10	.
1ST Borg scale on exertion	.26	10	.06	.77	10	.01
2nd Borg scale at rest	.	10	.	.	10	.
Borg scale on exertion	.32	10	.01	.71	10	.00
Distance 1st test	.22	10	.20*	.88	10	.15
Distance 2nd test	.23	10	.16	.89	10	.16
1st RPE at rest	.	10	.	.	10	.
1st RPE on exertion	.52	10	.00	.37	10	.00
2nd RPE at rest	.	10	.	.	10	.
2nd RPE on exertion	.38	10	.00	.64	10	.00
1st Peak VO2	.22	10	.20*	.88	10	.15
2nd Peak VO2	.23	10	.16	.89	10	.16

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

Appendix 6 - Correlations

Notes

Output Created		01-MAR-2021 15:16:40
Comments		
Input	Active Dataset	DataSet2
	Filter	<none>
	Weight	<none>
	Split File	<none>
	N of Rows in Working Data File	11
Missing Value Handling	Definition of Missing	User-defined missing values are treated as missing.
	Cases Used	Statistics for each pair of variables are based on all the cases with valid data for that pair.
Syntax		CORRELATIONS /VARIABLES=Age BMI Cobbangle Height Weight @2ndRPEonexertion Distance2ndtest HRonexertion2nd @2ndPeakVO2 Borgscaleonexertion @2ndBorgscaleatrest HRatrest2nd SpO2after2nd SpO2after1st /PRINT=TWOTAIL NOSIG FULL /STATISTICS DESCRIPTIVES /MISSING=PAIRWISE.
Resources	Processor Time	00:00:00.06
	Elapsed Time	00:00:00.23

Descriptive Statistics

Mean		Std. Deviation	N
Age	14.70	1.49	10
BMI	18.38	2.04	10
Cobb angle	28.10	8.48	10
Height	1.60	.07	10
Weight	47.20	7.18	10
2nd RPE on exertion	9.80	1.03	10
Distance 2nd test	522.00	102.83	10
HR on exertion 2nd	136.10	10.08	10
2nd Peak VO2	17.24	2.57	10
Borg scale on exertion	2.10	.99	10
2nd Borg scale at rest	.00	.00	10
HR at rest 2nd	82.70	11.36	10
SpO2 after 2nd	95.30	1.42	10
SpO2 after 1st	95.90	.99	10

Correlations

		Age	BMI	Cobb angle	Height
Age	Pearson Correlation	1	.089	-.155	.734*
	Sig. (2-tailed)		.807	.669	.016
	N	10	10	10	10
BMI	Pearson Correlation	.089	1	.509	.327
	Sig. (2-tailed)	.807		.133	.357
	N	10	10	10	10
Cobb angle	Pearson Correlation	-.155	.509	1	.140
	Sig. (2-tailed)	.669	.133		.701
	N	10	10	10	10
Height	Pearson Correlation	.734*	.327	.140	1
	Sig. (2-tailed)	.016	.357	.701	
	N	10	10	10	10
Weight	Pearson Correlation	.410	.893**	.432	.717*
	Sig. (2-tailed)	.239	.001	.212	.020
	N	10	10	10	10
2nd RPE on exertion	Pearson Correlation	.173	-.678*	-.721*	.033
	Sig. (2-tailed)	.633	.031	.019	.927
	N	10	10	10	10

			HR on exertion 2nd	
HR at rest 1st	Interquartile Range	Statistic		
		3.00		
		-.07		R

Correlations

Notes

Output Created		01-MAR-2021 15:16:40
Comments		
Input	Active Dataset	DataSet2
	Filter	<none>
	Weight	<none>
	Split File	<none>
	N of Rows in Working Data File	11
Missing Value Handling	Definition of Missing	User-defined missing values are treated as missing.
	Cases Used	Statistics for each pair of variables are based on all the cases with valid data for that pair.
Syntax		CORRELATIONS /VARIABLES=Age BMI Cobbangle Height Weight @2ndRPEonexertion Distance2ndtest HRonexertion2nd @2ndPeakVO2 Borgscaleonexertion @2ndBorgscaleatrest HRatrest2nd SpO2after2nd SpO2after1st /PRINT=TWOTAIL NOSIG FULL /STATISTICS DESCRIPTIVES /MISSING=PAIRWISE.
Resources	Processor Time	00:00:00.06
	Elapsed Time	00:00:00.23

Descriptive Statistics

	Mean	Std. Deviation	N
Age	14.70	1.49	10
BMI	18.38	2.04	10
Cobb angle	28.10	8.48	10
Height	1.60	.07	10
Weight	47.20	7.18	10
2nd RPE on exertion	9.80	1.03	10
Distance 2nd test	522.00	102.83	10
HR on exertion 2nd	136.10	10.08	10
2nd Peak VO2	17.24	2.57	10
Borg scale on exertion	2.10	.99	10
2nd Borg scale at rest	.00	.00	10
HR at rest 2nd	82.70	11.36	10
SpO2 after 2nd	95.30	1.42	10
SpO2 after 1st	95.90	.99	10

Correlations

Age			BMI	Cobb angle	Height
Age	Pearson Correlation	1	.089	-.155	.734*
	Sig. (2-tailed)		.807	.669	.016
	N	10	10	10	10
BMI	Pearson Correlation	.089	1	.509	.327
	Sig. (2-tailed)	.807		.133	.357
	N	10	10	10	10
Cobb angle	Pearson Correlation	-.155	.509	1	.140
	Sig. (2-tailed)	.669	.133		.701
	N	10	10	10	10
Height	Pearson Correlation	.734*	.327	.140	1
	Sig. (2-tailed)	.016	.357	.701	
	N	10	10	10	10
Weight	Pearson Correlation	.410	.893**	.432	.717*
	Sig. (2-tailed)	.239	.001	.212	.020
	N	10	10	10	10
2nd RPE on exertion	Pearson Correlation	.173	-.678*	-.721*	.033
	Sig. (2-tailed)	.633	.031	.019	.927
	N	10	10	10	10

			Statistic	2nd Borg scale at rest
		M	73.90	
Statistic	Percentage HR 2nd test	a	17.00	
38.00		x	5.77	
16.50		i	.13	
1.17		m	.09	
1.74		u	66.29	
136.10		m	62.83	
128.89		R	69.75	
143.31		a	66.21	
135.89		n	65.30	
134.50		g	23.46	
101.66		e	4.84	
10.08		I	58.80	
120.00		n	75.30	
156.00		t	16.50	
36.00			5.83	
11.00			.47	
57			--	
			Sta	

Correlations

		2nd Borg scale at rest	HR at rest 2nd	SpO2 after 2nd
Age	Pearson Correlation	[b]	-.484	.467
	Sig. (2-tailed)	.	.157	.174
	N	10	10	10
BMI	Pearson Correlation	[b]	-.529	-.240
	Sig. (2-tailed)	.	.116	.504
	N	10	10	10
Cobb angle	Pearson Correlation	[b]	.112	.108
	Sig. (2-tailed)	.	.758	.766
	N	10	10	10
Height	Pearson Correlation	[b]	-.597	.024
	Sig. (2-tailed)	.	.068	.947
	N	10	10	10
Weight	Pearson Correlation	[b]	-.684*	-.181
	Sig. (2-tailed)	.	.029	.616
	N	10	10	10
2nd RPE on exertion	Pearson Correlation	[b]	-.148	-.030
	Sig. (2-tailed)	.	.684	.934
	N	10	10	10

Correlations

		HR on exertion 2nd	2nd Peak VO2	Borg scale on exertion
Age	Pearson Correlation	-.153	.576	.396
	Sig. (2-tailed)	.674	.082	.257
	N	10	10	10
BMI	Pearson Correlation	-.482	.373	-.498
	Sig. (2-tailed)	.159	.288	.143
	N	10	10	10
Cobb angle	Pearson Correlation	-.489	.373	-.449
	Sig. (2-tailed)	.152	.288	.193
	N	10	10	10
Height	Pearson Correlation	-.303	.717*	.190
	Sig. (2-tailed)	.395	.020	.600
	N	10	10	10
Weight	Pearson Correlation	-.484	.617	-.268
	Sig. (2-tailed)	.156	.058	.454
	N	10	10	10
2nd RPE on exertion	Pearson Correlation	.610	-.184	.779**
	Sig. (2-tailed)	.061	.611	.008
	N	10	10	10

		SpO2 after 1st
Age	Pearson Correlation	.426
	Sig. (2-tailed)	.219
	N	10
BMI	Pearson Correlation	-.341
	Sig. (2-tailed)	.334
	N	10
Cobb angle	Pearson Correlation	.094
	Sig. (2-tailed)	.797
	N	10
Height	Pearson Correlation	.052
	Sig. (2-tailed)	.887
	N	10
Weight	Pearson Correlation	-.246
	Sig. (2-tailed)	.493
	N	10
2nd RPE on exertion	Pearson Correlation	-.130
	Sig. (2-tailed)	.721
	N	10

			1	Distance 2nd test
Minimum			3	
Maximum			2	
Range			2	
Interquartile Range			.00	
Skewness			-2.13	
Kurtosis			.00	
Mean			.00	
95% Confidence Interval for Mean	Lower Bound		.00	
	Upper Bound		.00	
			.00	
			.00	
			.00	
			0	
			0	
			0	
			0	
			.	
			.	2.10
			1.39	
			2.81	
			2.11	
			2.50	
			.99	
			.99	
			1.00	

			Statistic	2nd RPE at rest
Mean			97.78	
95% Confidence Interval for Mean	Lower Bound		380	
	Upper Bound		640	
5% Trimmed Mean			260	
Median			200	
Variance			.235	
Std. Deviation			-1.79	
Minimum			522.00	
Maximum			448.44	
Range			595.56	
Interquartile Range			521.67	
Skewness			505.00	
Kurtosis			10573.33	
Mean			102.83	
95% Confidence Interval for Mean	Lower Bound		390	
	Upper Bound		660	
5% Trimmed Mean			270	
Median			208	
Variance			.25	
Std. Deviation			-1.75	
Minimum			6.00	
Maximum			6.00	
Range			6.00	
Interquartile Range			6.00	
Skewness			6.00	
Kurtosis			6.00	

Correlations

		HR on exertion 2nd	2nd Peak VO2	Borg scale on exertion
Distance 2nd test	Pearson Correlation	-.083	1.000**	.237
	Sig. (2-tailed)	.820	.000	.510
	N	10	10	10
HR on exertion 2nd	Pearson Correlation	1	-.083	.708*
	Sig. (2-tailed)		.820	.022
	N	10	10	10
2nd Peak VO2	Pearson Correlation	-.083	1	.237
	Sig. (2-tailed)	.820		.510
	N	10	10	10
Borg scale on exertion	Pearson Correlation	.708*	.237	1
	Sig. (2-tailed)	.022	.510	
	N	10	10	10
2nd Borg scale at rest	Pearson Correlation	b	b	b
	Sig. (2-tailed)	.	.	.
	N	10	10	10
HR at rest 2nd	Pearson Correlation	.169	-.251	-.066
	Sig. (2-tailed)	.641	.483	.857
	N	10	10	10
SpO2 after 2nd	Pearson Correlation	-.080	.018	.055
	Sig. (2-tailed)	.826	.960	.880
	N	10	10	10
SpO2 after 1st	Pearson Correlation	-.143	.100	.011
	Sig. (2-tailed)	.694	.783	.975
	N	10	10	10

Correlations

		2nd Borg scale at rest	HR at rest 2nd	SpO2 after 2nd
Distance 2nd test	Pearson Correlation	[b]	-.251	.018
	Sig. (2-tailed)	.	.483	.960
	N	10	10	10
HR on exertion 2nd	Pearson Correlation	[b]	.169	-.080
	Sig. (2-tailed)	.	.641	.826
	N	10	10	10
2nd Peak VO2	Pearson Correlation	[b]	-.251	.018
	Sig. (2-tailed)	.	.483	.960
	N	10	10	10
Borg scale on exertion	Pearson Correlation	[b]	-.066	.055
	Sig. (2-tailed)	.	.857	.880
	N	10	10	10
2nd Borg scale at rest	Pearson Correlation	[b]	[b]	[b]
	Sig. (2-tailed)		.	.
	N	10	10	10
HR at rest 2nd	Pearson Correlation	[b]	1	.158
	Sig. (2-tailed)	.		.663
	N	10	10	10
SpO2 after 2nd	Pearson Correlation	[b]	.158	1
	Sig. (2-tailed)	.	.663	
	N	10	10	10
SpO2 after 1st	Pearson Correlation	[b]	.440	.890**
	Sig. (2-tailed)	.	.204	.001
	N	10	10	10

		SpO2 after 1st
Distance 2nd test	Pearson Correlation	.100
	Sig. (2-tailed)	.783
	N	10
HR on exertion 2nd	Pearson Correlation	-.143
	Sig. (2-tailed)	.694
	N	10
2nd Peak VO2	Pearson Correlation	.100
	Sig. (2-tailed)	.783
	N	10
Borg scale on exertion	Pearson Correlation	.011
	Sig. (2-tailed)	.975
	N	10
2nd Borg scale at rest	Pearson Correlation	.[b]
	Sig. (2-tailed)	.
	N	10
HR at rest 2nd	Pearson Correlation	.440
	Sig. (2-tailed)	.204
	N	10
SpO2 after 2nd	Pearson Correlation	.890**
	Sig. (2-tailed)	.001
	N	10
SpO2 after 1st	Pearson Correlation	1
	Sig. (2-tailed)	
	N	10

***. Correlation is significant at the 0.05 level (2-tailed).**
****. Correlation is significant at the 0.01 level (2-tailed).**
b. Cannot be computed because at least one of the variables is constant.

Appendix 7 - Nonparametric Correlations

Notes

Output Created		24-FEB-2021 17:31:20
Comments		
Input	Active Dataset	DataSet1
	Filter	<none>
	Weight	<none>
	Split File	<none>
	N of Rows in Working Data File	11
Missing Value Handling	Definition of Missing	User-defined missing values are treated as missing.
	Cases Used	Statistics for each pair of variables are based on all the cases with valid data for that pair.

Notes

Syntax		NONPAR CORR /VARIABLES=Cobbangle @2ndPeakVO2 Distance2ndtest Borgscaleonexertion @2ndRPEonexertion HRonexertion2nd SpO2after2nd Height Weight /PRINT=SPEARMAN TWOTAIL NOSIG FULL /MISSING=PAIRWISE.
Resources	Processor Time	00:00:00.02
	Elapsed Time	00:00:00.01
	Number of Cases Allowed	262144 cases[a]

a. Based on availability of workspace memory

[DataSet1]

Correlations

			Cobb angle	2nd Peak VO2
Spearman's rho	Cobb angle	Correlation Coefficient	1.000	.484
		Sig. (2-tailed)	.	.131
		N	11	11
	2nd Peak VO2	Correlation Coefficient	.484	1.000
		Sig. (2-tailed)	.131	.
		N	11	11
	Distance 2nd test	Correlation Coefficient	.484	1.000**
		Sig. (2-tailed)	.131	.
		N	11	11
	Borg scale on exertion	Correlation Coefficient	-.516	.059
		Sig. (2-tailed)	.104	.864
		N	11	11
	2nd RPE on exertion	Correlation Coefficient	-.768**	-.306
		Sig. (2-tailed)	.006	.360
		N	11	11
	HR on exertion 2nd	Correlation Coefficient	-.357	-.077
		Sig. (2-tailed)	.281	.821
		N	11	11

			Median
	5	2nd Peak VO2	
	Statistic		
	.40		
	.63		
	9.00		
	11.00		
	2.00		
	.00		
	3.16		
	10.00		
	6.00		
	6.00		
	6.00		
	6.00		

			Weight	
	Statistic 16.44	Pearson CorrelationSig.		.410
		(2-tailed)		.239
		N		10
	Age	Pearson CorrelationSig.	.893**	
		(2-tailed)		.001
		N		10
	BMI	Pearson CorrelationSig.		.432
		(2-tailed)		.212
		N		10
	Cobb angle	Pearson CorrelationSig.	.717*	
		(2-tailed)		.020
		N		10
	Height	Pearson CorrelationSig.		1
		(2-tailed)		
		N		
	Weight	Pearson CorrelationSig.		
		(2-tailed)		
		N		

		10		
10				
	2nd RPE onexertion			
		.173		
		.633		
		10		
		-.678*		
		.031		
		10		
		-.721*		
		.019		
		10		
		.033		
		.927		
		10		

			Weight
Spearman's rho	Cobb angle	Correlation Coefficient	.662*
		Sig. (2-tailed)	.026
		N	11
	2nd Peak VO2	Correlation Coefficient	.741**
		Sig. (2-tailed)	.009
		N	11
	Distance 2nd test	Correlation Coefficient	.741**
		Sig. (2-tailed)	.009
		N	11
	Borg scale on exertion	Correlation Coefficient	-.303
		Sig. (2-tailed)	.365
		N	11
	2nd RPE on exertion	Correlation Coefficient	-.595
		Sig. (2-tailed)	.053
		N	11
	HR on exertion 2nd	Correlation Coefficient	-.431
		Sig. (2-tailed)	.185
		N	11

Correlations

		Age
Distance 2nd test		
.576	BMI	
.082		
10		
	Cobb angle	

			Distance 2nd test	Borg scale on exertion
	SpO2 after 2nd	Correlation Coefficient	-.023	-.027
		Sig. (2-tailed)	.946	.936
		N	11	11
	Height	Correlation Coefficient	.817**	.331
		Sig. (2-tailed)	.002	.321
		N	11	11
	Weight	Correlation Coefficient	.741**	-.303
		Sig. (2-tailed)	.009	.365
		N	11	11

Correlations

			2nd RPE on exertion	HR on exertion 2nd
	SpO2 after 2nd	Correlation Coefficient	-.057	.040
		Sig. (2-tailed)	.867	.908
		N	11	11
	Height	Correlation Coefficient	.100	.005
		Sig. (2-tailed)	.769	.989
		N	11	11
	Weight	Correlation Coefficient	-.595	-.431
		Sig. (2-tailed)	.053	.185
		N	11	11

Correlations

		Weight		
	Pearson Correlation			.410
				.239
	Sig. (2-tailed)			10
		.893**		
	N			.001
				10

		Weight
SpO2 after 2nd	Correlation Coefficient	-.192
	Sig. (2-tailed)	.572
	N	11
Height	Correlation Coefficient	.637*
	Sig. (2-tailed)	.035
	N	11
Weight	Correlation Coefficient	1.000
	Sig. (2-tailed)	.
	N	11

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Appendix 8 - Comparison with AIS Sperandio

T-Test

Notes

Output Created		24-FEB-2021 16:57:10
Comments		
Input	Active Dataset	DataSet2
	Filter	<none>
	Weight	<none>
	Split File	<none>
	N of Rows in Working Data File	10
Missing Value Handling	Definition of Missing	User defined missing values are treated as missing.
	Cases Used	Statistics for each analysis are based on the cases with no missing or out-of-range data for any variable in the analysis.
Syntax		T-TEST /TESTVAL=498 /MISSING=ANALYSIS /VARIABLES=Distance2ndtest /ES DISPLAY(TRUE) /CRITERIA=CI(.95).
Resources	Processor Time	00:00:00.02
	Elapsed Time	00:00:00.01

[DataSet2]

One-Sample Statistics

	N	Mean	Std. Deviation	Std. Error Mean
Distance 2nd test	10	522.00	102.827	32.517

One-Sample Test

	10				
	2	1	Distance	Distance 2nd	Age .576
Distance 2ndtest	2nd RPE	Weight	Distance 2nd	Height	BMI

One-Sample Test

	Test Value = 498	
	95% Confidence Interval of the ...	
	Upper	
Distance 2nd test	97.56	

One-Sample Effect Sizes

		Standardizer[a]	Point Estimate	95% Confidence Interval	
				Lower	Upper
Distance 2nd test	Cohen's d	102.827	.233	-.402	.856
	Hedges' correction	112.517	.213	-.367	.782

a. The denominator used in estimating the effect sizes.Cohen's d uses the sample standard deviation.
Hedges' correction uses the sample standard deviation, plus a correction factor.

T-Test

Output Created		24-FEB-2021 16:58:13
Comments		
Input	Active Dataset	DataSet2
	Filter	<none>
	Weight	<none>
	Split File	<none>
	N of Rows in Working Data File	10
Missing Value Handling	Definition of Missing	User defined missing values are treated as missing.
	Cases Used	Statistics for each analysis are based on the cases with no missing or out-of-range data for any variable in the analysis.
Syntax		T-TEST /TESTVAL=25 /MISSING=ANALYSIS /VARIABLES=@2ndPeak VO2 /ES DISPLAY(TRUE) /CRITERIA=CI(.95).
Resources	Processor Time	00:00:00.02
	Elapsed Time	00:00:00.01

One-Sample Statistics

	N	Mean	Std. Deviation	Std. Error Mean
2nd Peak VO2	10	17.24000000	2.570667877	.8129165599

One-Sample Test

			10		
	S	2	Correlation	Distance 2n	Spearman's rho
	2nd Peak	Spearman'	2nd RPE	Correlation	2nd Peak VO2

One-Sample Test

	Te
	st
	Val

	ue = 25 95 % Co nfi de nc e Interval of the ...
	Upper
2nd Peak VO2	-5.92105498

Notes

		Standardizer[a]	Point Estimate	95% Confidence Interval	
				Lower	Upper
2nd Peak VO2	Cohen's d	2.570667877	-3.019	-4.510	-1.503
	Hedges' correction	2.812931945	-2.759	-4.121	-1.374

a. The denominator used in estimating the effect sizes.Cohen's d uses the sample standard deviation.
Hedges' correction uses the sample standard deviation, plus a correction factor.

T-Test

Notes

Output Created		24-FEB-2021 16:59:53
Comments		
Input	Active Dataset	DataSet2
	Filter	<none>
	Weight	<none>
	Split File	<none>
	N of Rows in Working Data File	10
Missing Value Handling	Definition of Missing	User defined missing values are treated as missing.
	Cases Used	Statistics for each analysis are based on the cases with no missing or out-of-range data for any variable in the analysis.
Syntax		T-TEST /TESTVAL=39.5 /MISSING=ANALYSIS /VARIABLES=Cobbangle /ES DISPLAY(TRUE) /CRITERIA=CI(.95).

Resources	Processor Time	00:00:00.00
	Elapsed Time	00:00:00.01

One-Sample Statistics

	N	Mean	Std. Deviation	Std. Error Mean
Cobb angle	10	28.100	8.4781	2.6810

One-Sample Test

Test Value = 39.5

	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
Cobb angle	-4.252	9	.002	-11.4000	-17.465	-5.335

One-Sample Effect Sizes

		Standardizer[a]	Point Estimate	95% Confidence Interval	
				Lower	Upper
Cobb angle	Cohen's d	8.4781	-1.345	-2.197	-.456
	Hedges' correction	9.2771	-1.229	-2.008	-.417

a. The denominator used in estimating the effect sizes.Cohen's d uses the sample standard deviation.
Hedges' correction uses the sample standard deviation, plus a correction factor.

T-Test

Output Created		24-FEB-2021 17:00:47
Comments		
Input	Active Dataset	DataSet2
	Filter	<none>
	Weight	<none>
	Split File	<none>
	N of Rows in Working Data File	10
Missing Value Handling	Definition of Missing	User defined missing values are treated as missing.
	Cases Used	Statistics for each analysis are based on the cases with no missing or out-of-range data for any variable in the analysis.
Syntax		T-TEST /TESTVAL=1.59 /MISSING=ANALYSIS /VARIABLES=Height /ES DISPLAY(TRUE) /CRITERIA=CI(.95).
Resources	Processor Time	00:00:00.02
	Elapsed Time	00:00:00.01

One-Sample Statistics

	N	Mean	Std. Deviation	Std. Error Mean
Height	10	1.6000	.06481	.02049

One-Sample Test

Test Value = 1.59

	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
Height	.488	9	.637	.01000	-.0364	.0564

One-Sample Effect Sizes

		Standardizer[a]	Point Estimate	95% Confidence Interval Lower	95% Confidence Interval Upper
Height	Cohen's d	.06481	.154	-.474	.774
	Hedges' correction	.07091	.141	-.433	.707

a. The denominator used in estimating the effect sizes.Cohen's d uses the sample standard deviation.
Hedges' correction uses the sample standard deviation, plus a correction factor.

T-Test

Notes

Output Created		24-FEB-2021 17:01:04
Comments		
Input	Active Dataset	DataSet2
	Filter	<none>
	Weight	<none>
	Split File	<none>
	N of Rows in Working Data File	10
Missing Value Handling	Definition of Missing	User defined missing values are treated as missing.
	Cases Used	Statistics for each analysis are based on the cases with no missing or out-of-range data for any variable in the analysis.
Syntax		T-TEST /TESTVAL=47 /MISSING=ANALYSIS /VARIABLES=Weight /ES DISPLAY(TRUE) /CRITERIA=CI(.95).
Resources	Processor Time	00:00:00.05
	Elapsed Time	00:00:00.02

	N	Mean	Std. Deviation	Std. Error Mean
Weight	10	47.200	7.1771	2.2696

One-Sample Test

	Test Value = 47					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
Weight	.088	9	.932	.2000	-4.934	5.334

One-Sample Effect Sizes

				95% Confidence Interval	
		Standardizer[a]	Point Estimate	Lower	Upper
Weight	Cohen's d	7.1771	.028	-.593	.647
	Hedges' correction	7.8535	.025	-.542	.591

a. The denominator used in estimating the effect sizes.Cohen's d uses the sample standard deviation.
Hedges' correction uses the sample standard deviation, plus a correction factor.

T-Test

Output Created		24-FEB-2021 17:01:39
Comments		
Input	Active Dataset	DataSet2
	Filter	<none>
	Weight	<none>
	Split File	<none>
	N of Rows in Working Data File	10
Missing Value Handling	Definition of Missing	User defined missing values are treated as missing.
	Cases Used	Statistics for each analysis are based on the cases with no missing or out-of-range data for any variable in the analysis.
Syntax		T-TEST /TESTVAL=171 /MISSING=ANALYSIS /VARIABLES=HRonexertion2nd /ES DISPLAY(TRUE) /CRITERIA=CI(.95).
Resources	Processor Time	00:00:00.02
	Elapsed Time	00:00:00.01

One-Sample Statistics

	N	Mean	Std. Deviation	Std. Error Mean
HR on exertion 2nd	10	136.100	10.0824	3.1883

One-Sample Test

	SpO2 after				
					t
	S		Test Value =		
24.000	95%	Mean	Sig. (2-tailed)	df	

One-Sample Test

	Test Value = 171
	95% Confidence Interva

	l of the ... Notes
	Upper
HR on exertion 2nd	-27.687

		Standardizer[a]	Point Estimate	95% Confidence Interval	
				Lower	Upper
HR on exertion 2nd	Cohen's d	10.0824	-3.461	-5.139	-1.763
	Hedges' correction	11.0326	-3.163	-4.696	-1.611

a. The denominator used in estimating the effect sizes.Cohen's d uses the sample standard deviation.
Hedges' correction uses the sample standard deviation, plus a correction factor.

```
T-TEST
 /TESTVAL=4
 /MISSING=ANALYSIS
 /VARIABLES=Borgscaleonexertion
 /ES DISPLAY(TRUE)
 /CRITERIA=CI(.95).
```

T-Test

Notes

Output Created		24-FEB-2021 17:02:17
Comments		
Input	Active Dataset	DataSet2
	Filter	<none>
	Weight	<none>
	Split File	<none>
	N of Rows in Working Data File	10
Missing Value Handling	Definition of Missing	User defined missing values are treated as missing.
	Cases Used	Statistics for each analysis are based on the cases with no missing or out-of-range data for any variable in the analysis.
Syntax		T-TEST /TESTVAL=4 /MISSING=ANALYSIS /VARIABLES=Borgscaleonexertion /ES DISPLAY(TRUE) /CRITERIA=CI(.95).
Resources	Processor Time	00:00:00.02
	Elapsed Time	00:00:00.02

One-Sample Statistics

	N	Mean	Std. Deviation	Std. Error Mean
Borg scale on exertion	10	2.100	.9944	.3145

One-Sample Test

	t				
			Test Value =		
-7.76000000	-	95%	Mean	Sig. (2-tailed)	df

One-Sample Test

	Test Value = 4 95% Confidence Interval of the ...
	Upper
Borg scale on exertion	-1.189

One-Sample Effect Sizes

		Standardizer[a]	Point Estimate	95% ... Lower
Borg scale on exertion	Cohen's d	.9944	-1.911	-2.960
	Hedges' correction	1.0881	-1.746	-2.705

One-Sample Effect Sizes

		95% ...
		Upper
Borg scale on exertion	Cohen's d	-.827
	Hedges' correction	-.756

a. The denominator used in estimating the effect sizes.Cohen's d uses the sample standard deviation.
Hedges' correction uses the sample standard deviation, plus a correction factor.

Appendix 9 - Comparison with Sperandio

```
T-TEST
  /TESTVAL=604
  /MISSING=ANALYSIS
  /VARIABLES=Distance2ndtest
  /ES DISPLAY(TRUE)
  /CRITERIA=CI(.95).
```

T-Test

Notes

Output Created		24-FEB-2021 17:23:29
Comments		
Input	Active Dataset	DataSet2
	Filter	<none>
	Weight	<none>
	Split File	<none>
	N of Rows in Working Data File	10
Missing Value Handling	Definition of Missing	User defined missing values are treated as missing.
	Cases Used	Statistics for each analysis are based on the cases with no missing or out-of-range data for any variable in the analysis.
Syntax		T-TEST /TESTVAL=604 /MISSING=ANALYSIS /VARIABLES=Distance2ndtest /ES DISPLAY(TRUE) /CRITERIA=CI(.95).
Resources	Processor Time	00:00:00.00
	Elapsed Time	00:00:00.01

One-Sample Statistics

	N	Mean	Std. Deviation	Std. Error Mean
Distance 2nd test	10	522.00	102.827	32.517

One-Sample Test

	t	Test Value =			
			95%	Mean	Sig. (2-tailed)	df
-34.9000	-				

One-Sample Test

	Test Value = 604 95% Confidence Interval of the ...
	Upper
Distance 2nd test	-8.44

One-Sample Effect Sizes

		Standardizer[a]	Point Estimate	95% Confidence Interval	
				Lower	Upper
Distance 2nd test	Cohen's d	102.827	-.797	-1.500	-.063
	Hedges' correction	112.517	-.729	-1.370	-.058

a. The denominator used in estimating the effect sizes.Cohen's d uses the sample standard deviation.
Hedges' correction uses the sample standard deviation, plus a correction factor.

```
T-TEST
 /TESTVAL=28
 /MISSING=ANALYSIS
 /VARIABLES=@2ndPeakVO2
 /ES DISPLAY(TRUE)
 /CRITERIA=CI(.95).
```

T-Test

Output Created		24-FEB-2021 17:23:46
Comments		
Input	Active Dataset	DataSet2
	Filter	<none>
	Weight	<none>
	Split File	<none>
	N of Rows in Working Data File	10
Missing Value Handling	Definition of Missing	User defined missing values are treated as missing.
	Cases Used	Statistics for each analysis are based on the cases with no missing or out-of-range data for any variable in the analysis.
Syntax		T-TEST /TESTVAL=28 /MISSING=ANALYSIS /VARIABLES=@2ndPeak VO2 /ES DISPLAY(TRUE) /CRITERIA=CI(.95).
Resources	Processor Time	00:00:00.00
	Elapsed Time	00:00:00.01

One-Sample Statistics

	N	Mean	Std. Deviation	Std. Error Mean
2nd Peak VO2	10	17.24000000	2.570667877	.8129165599

One-Sample Test

	t		0		
			Test Value =		
-	-	95%	Mean	Sig. (2-tailed)	df

One-Sample Test

Test Valu e = 28 95% Conf

	iden ce	Notes
	Interval of the ...	
	Upper	
2nd Peak VO2	-8.92105498	

		Standardizer[a]	Point Estimate	95% Confidence Interval	
				Lower	Upper
2nd Peak VO2	Cohen's d	2.570667877	-4.186	-6.174	-2.181
	Hedges' correction	2.812931945	-3.825	-5.642	-1.993

a. The denominator used in estimating the effect sizes.Cohen's d uses the sample standard deviation.
Hedges' correction uses the sample standard deviation, plus a correction factor.

T-Test

Notes

Output Created		24-FEB-2021 17:24:05
Comments		
Input	Active Dataset	DataSet2
	Filter	<none>
	Weight	<none>
	Split File	<none>
	N of Rows in Working Data File	10
Missing Value Handling	Definition of Missing	User defined missing values are treated as missing.
	Cases Used	Statistics for each analysis are based on the cases with no missing or out-of-range data for any variable in the analysis.
Syntax		T-TEST /TESTVAL=19 /MISSING=ANALYSIS /VARIABLES=BMI /ES DISPLAY(TRUE) /CRITERIA=CI(.95).
Resources	Processor Time	00:00:00.00
	Elapsed Time	00:00:00.00

	N	Mean	Std. Deviation	Std. Error Mean
BMI	10	18.3800	2.03623	.64391

One-Sample Test

	Test Value = 19					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
BMI	-.963	9	.361	-.62000	-2.0766	.8366

One-Sample Effect Sizes

		Standardizer[a]	Point Estimate	95% Confidence Interval	
				Lower	Upper
BMI	Cohen's d	2.03623	-.304	-.932	.339
	Hedges' correction	2.22812	-.278	-.851	.309

a. The denominator used in estimating the effect sizes.Cohen's d uses the sample standard deviation.
Hedges' correction uses the sample standard deviation, plus a correction factor.

T-Test

Output Created		24-FEB-2021 17:24:24
Comments		
Input	Active Dataset	DataSet2
	Filter	<none>
	Weight	<none>
	Split File	<none>
	N of Rows in Working Data File	10
Missing Value Handling	Definition of Missing	User defined missing values are treated as missing.
	Cases Used	Statistics for each analysis are based on the cases with no missing or out-of-range data for any variable in the analysis.
Syntax		T-TEST /TESTVAL=178 /MISSING=ANALYSIS /VARIABLES=HRonexertion2nd /ES DISPLAY(TRUE) /CRITERIA=CI(.95).
Resources	Processor Time	00:00:00.00
	Elapsed Time	00:00:00.00

One-Sample Statistics

	N	Mean	Std. Deviation	Std. Error Mean
HR on exertion 2nd	10	136.100	10.0824	3.1883

One-Sample Test

	t				
			Test Value = 0		
	f				
-82.000	-	95%	Mean	Sig. (2-tailed)	df

One-Sample Test

Test Value = 178

95% Confidence

	Interval of the Notes	
		Upper
HR on exertion 2nd		-34.687

		Standardizer[a]	Point Estimate	95% Confidence Interval	
				Lower	Upper
HR on exertion 2nd	Cohen's d	10.0824	-4.156	-6.131	-2.164
	Hedges' correction	11.0326	-3.798	-5.603	-1.978

a. The denominator used in estimating the effect sizes.Cohen's d uses the sample standard deviation.
Hedges' correction uses the sample standard deviation, plus a correction factor.

T-Test

Notes

Output Created		24-FEB-2021 17:24:38
Comments		
Input	Active Dataset	DataSet2
	Filter	<none>
	Weight	<none>
	Split File	<none>
	N of Rows in Working Data File	10
Missing Value Handling	Definition of Missing	User defined missing values are treated as missing.
	Cases Used	Statistics for each analysis are based on the cases with no missing or out-of-range data for any variable in the analysis.
Syntax		T-TEST /TESTVAL=52 /MISSING=ANALYSIS /VARIABLES=Weight /ES DISPLAY(TRUE) /CRITERIA=CI(.95).
Resources	Processor Time	00:00:00.02
	Elapsed Time	00:00:00.00

	N	Mean	Std. Deviation	Std. Error Mean
Weight	10	47.200	7.1771	2.2696

One-Sample Test

	Test Value = 52					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
Weight	-2.115	9	.064	-4.8000	-9.934	.334

One-Sample Effect Sizes

		Standardizer[a]	Point Estimate	95% Confidence Interval	
				Lower	Upper
Weight	Cohen's d	7.1771	-.669	-1.345	.036
	Hedges' correction	7.8535	-.611	-1.229	.033

a. The denominator used in estimating the effect sizes.Cohen's d uses the sample standard deviation.
Hedges' correction uses the sample standard deviation, plus a correction factor.

T-Test

Output Created		24-FEB-2021 17:24:53
Comments		
Input	Active Dataset	DataSet2
	Filter	<none>
	Weight	<none>
	Split File	<none>
	N of Rows in Working Data File	10
Missing Value Handling	Definition of Missing	User defined missing values are treated as missing.
	Cases Used	Statistics for each analysis are based on the cases with no missing or out-of-range data for any variable in the analysis.
Syntax		T-TEST /TESTVAL=1.62 /MISSING=ANALYSIS /VARIABLES=Height /ES DISPLAY(TRUE) /CRITERIA=CI(.95).
Resources	Processor Time	00:00:00.00
	Elapsed Time	00:00:00.00

One-Sample Statistics

	N	Mean	Std. Deviation	Std. Error Mean
Height	10	1.6000	.06481	.02049

One-Sample Test

Test Value = 1.62

	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
Height	-.976	9	.355	-.02000	-.0664	.0264

		Standardizer[a]	Point Estimate	95% Confidence Interval	
				Lower	Upper
Height	Cohen's d	.06481	-.309	-.936	.335
	Hedges' correction	.07091	-.282	-.855	.306

a. The denominator used in estimating the effect sizes.Cohen's d uses the sample standard deviation.
Hedges' correction uses the sample standard deviation, plus a correction factor.

T-Test

Notes

Output Created		24-FEB-2021 17:25:15
Comments		
Input	Active Dataset	DataSet2
	Filter	<none>
	Weight	<none>
	Split File	<none>
	N of Rows in Working Data File	10
Missing Value Handling	Definition of Missing	User defined missing values are treated as missing.
	Cases Used	Statistics for each analysis are based on the cases with no missing or out-of-range data for any variable in the analysis.
Syntax		T-TEST /TESTVAL=3.4 /MISSING=ANALYSIS /VARIABLES=Borgscaleonexertion /ES DISPLAY(TRUE) /CRITERIA=CI(.95).
Resources	Processor Time	00:00:00.00
	Elapsed Time	00:00:00.00

	N	Mean	Std. Deviation	Std. Error Mean
Borg scale on exertion	10	2.100	.9944	.3145

One-Sample Test

t	Test Value = 0				
			95%	Mean	Sig. (2-tailed)	df
-10.7600000	-				

One-Sample Test

	Test Value = 3.4	
	95% Confidence Interval of the ...	
	Upper	
Borg scale on exertion	-.589	

One-Sample Effect Sizes

		Standardizer[a]	Point Estimate	95% ... Lower
Borg scale on exertion	Cohen's d	.9944	-1.307	-2.148
	Hedges' correction	1.0881	-1.195	-1.963

One-Sample Effect Sizes

		95% ... Upper
Borg scale on exertion	Cohen's d	-.430
	Hedges' correction	-.393

a. The denominator used in estimating the effect sizes.Cohen's d uses the sample standard deviation.
Hedges' correction uses the sample standard deviation, plus a correction factor.

Appendix 10 - Comparison with Vardhan

T-Test

Notes

Output Created		24-FEB-2021 17:26:39
Comments		
Input	Active Dataset	DataSet2
	Filter	<none>
	Weight	<none>
	Split File	<none>
	N of Rows in Working Data File	10
Missing Value Handling	Definition of Missing	User defined missing values are treated as missing.
	Cases Used	Statistics for each analysis are based on the cases with no missing or out-of-range data for any variable in the analysis.
Syntax		T-TEST /TESTVAL=445.32 /MISSING=ANALYSIS /VARIABLES=Distance2ndtest /ES DISPLAY(TRUE) /CRITERIA=CI(.95).
Resources	Processor Time	00:00:00.02
	Elapsed Time	00:00:00.01

One-Sample Statistics

	N	Mean	Std. Deviation	Std. Error Mean
Distance 2nd test	10	522.00	102.83	32.517

One-Sample Test

				Test Value =		t
-41.9000	-	95%	Mean	Sig. (2-tailed)	df	

One-Sample Test

	Test Value = ...	
	95% Confidence Interval of the ...	
	Upper	
Distance 2nd test	150.24	

One-Sample Effect Sizes

				95% Confidence Interval	
		Standardizer[a]	Point Estimate	Lower	Upper
Distance 2nd test	Cohen's d	102.827	.746	.023	1.437
	Hedges' correction	112.517	.681	.021	1.313

a. The denominator used in estimating the effect sizes.Cohen's d uses the sample standard deviation.
Hedges' correction uses the sample standard deviation, plus a correction factor.

T-Test

Notes

Output Created		24-FEB-2021 17:27:03
Comments		
Input	Active Dataset	DataSet2
	Filter	<none>
	Weight	<none>
	Split File	<none>
	N of Rows in Working Data File	10
Missing Value Handling	Definition of Missing	User defined missing values are treated as missing.
	Cases Used	Statistics for each analysis are based on the cases with no missing or out-of-range data for any variable in the analysis.
Syntax		T-TEST /TESTVAL=15.33 /MISSING=ANALYSIS /VARIABLES=@2ndPeak VO2 /ES DISPLAY(TRUE) /CRITERIA=CI(.95).
Resources	Processor Time	00:00:00.00
	Elapsed Time	00:00:00.01

One-Sample Statistics

	N	Mean	Std. Deviation	Std. Error Mean
2nd Peak VO2	10	17.24	2.57	.8129165599

One-Sample Test

	t			Test Value =	
		95%	Mean	Sig. (2-tailed)	df
-	-				

One-Sample Test

Test Value = ...	
95% Confidence	

	Interval of the ...
	Upper
2nd Peak VO2	3.748945019

One-Sample Effect Sizes

		Standardizer[a]	Point Estimate	95% Confidence Interval	
				Lower	Upper
2nd Peak VO2	Cohen's d	2.570667877	.743	.021	1.433
	Hedges' correction	2.812931945	.679	.020	1.310

a. The denominator used in estimating the effect sizes.Cohen's d uses the sample standard deviation.
Hedges' correction uses the sample standard deviation, plus a correction factor.

```
T-TEST
 /TESTVAL=18.06
 /MISSING=ANALYSIS
 /VARIABLES=BMI
 /ES DISPLAY(TRUE)
 /CRITERIA=CI(.95).
```

T-Test

Notes

Output Created		24-FEB-2021 17:27:20
Comments		
Input	Active Dataset	DataSet2
	Filter	<none>
	Weight	<none>
	Split File	<none>
	N of Rows in Working Data File	10
Missing Value Handling	Definition of Missing	User defined missing values are treated as missing.
	Cases Used	Statistics for each analysis are based on the cases with no missing or out-of-range data for any variable in the analysis.
Syntax		T-TEST /TESTVAL=18.06 /MISSING=ANALYSIS /VARIABLES=BMI /ES DISPLAY(TRUE) /CRITERIA=CI(.95).
Resources	Processor Time	00:00:00.02

	Elapsed Time	00:00:00.01

One-Sample Statistics

	N	Mean	Std. Deviation	Std. Error Mean
BMI	10	18.38	2.04	.64391

One-Sample Test

Test Value = 18.06

	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
BMI	.50	9	.63	.32000	-1.1366	1.7766

One-Sample Effect Sizes

		Standardizer[a]	Point Estimate	95% Confidence Interval	
				Lower	Upper
BMI	Cohen's d	2.03623	.157	-.471	.777
	Hedges' correction	2.22812	.144	-.430	.710

a. The denominator used in estimating the effect sizes.Cohen's d uses the sample standard deviation.
Hedges' correction uses the sample standard deviation, plus a correction factor.

2

T-Test

Notes

Output Created		12-MAR-2021 17:38:33
Comments		
Input	Active Dataset	DataSet1
	Filter	<none>
	Weight	<none>
	Split File	<none>
	N of Rows in Working Data File	10
Missing Value Handling	Definition of Missing	User defined missing values are treated as missing.
	Cases Used	Statistics for each analysis are based on the cases with no missing or out-of-range data for any variable in the analysis.
Syntax		T-TEST /TESTVAL=14 /MISSING=ANALYSIS /VARIABLES=Age /ES DISPLAY(TRUE) /CRITERIA=CI(.95).

Resources	Processor Time	00:00:00.03
	Elapsed Time	00:00:00.06

[DataSet1]

One-Sample Statistics

	N	Mean	Std. Deviation	Std. Error Mean
Age	10	14.70	1.49	.47

One-Sample Test

Test Value = 14

	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
Age	1.48	9	.17	.70	-.37	1.77

One-Sample Effect Sizes

		Standardizer[a]	Point Estimate	95% Confidence Interval	
				Lower	Upper
Age	Cohen's d	1.49	.47	-.20	1.11
	Hedges' correction	1.64	.43	-.18	1.01

a. The denominator used in estimating the effect sizes.Cohen's d uses the sample standard deviation.
Hedges' correction uses the sample standard deviation, plus a correction factor.

T-Test

Output Created		12-MAR-2021 17:39:03
Comments		
Input	Active Dataset	DataSet1
	Filter	<none>
	Weight	<none>
	Split File	<none>
	N of Rows in Working Data File	10
Missing Value Handling	Definition of Missing	User defined missing values are treated as missing.
	Cases Used	Statistics for each analysis are based on the cases with no missing or out-of-range data for any variable in the analysis.
Syntax		T-TEST /TESTVAL=12.3 /MISSING=ANALYSIS /VARIABLES=Age /ES DISPLAY(TRUE) /CRITERIA=CI(.95).
Resources	Processor Time	00:00:00.02
	Elapsed Time	00:00:00.01

One-Sample Statistics

	N	Mean	Std. Deviation	Std. Error Mean
Age	10	14.70	1.49	.47

One-Sample Test

Test Value = 12.3

	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
Age	5.08	9	.001	2.40	1.33	3.47

		Standardizer[a]	Point Estimate	95% Confidence Interval	
				Lower	Upper
Age	Cohen's d	1.49	1.61	.63	2.55
	Hedges' correction	1.64	1.47	.58	2.33

a. The denominator used in estimating the effect sizes.Cohen's d uses the sample standard deviation.
Hedges' correction uses the sample standard deviation, plus a correction factor.

Correlations

Notes

Output Created		12-MAR-2021 17:43:03
Comments		
Input	Active Dataset	DataSet1
	Filter	<none>
	Weight	<none>
	Split File	<none>
	N of Rows in Working Data File	10
Missing Value Handling	Definition of Missing	User-defined missing values are treated as missing.
	Cases Used	Statistics for each pair of variables are based on all the cases with valid data for that pair.

Syntax		CORRELATIONS /VARIABLES=Age Cobbangle @2ndRPEonexertion HRonexertion2nd Borgscaleonexertion Distance2ndtest @2ndPeakVO2 Height SpO2after1st SpO2after2nd Weight /PRINT=TWOTAIL NOSIG FULL /STATISTICS DESCRIPTIVES /MISSING=PAIRWISE.
Resources	Processor Time	00:00:00.03
	Elapsed Time	00:00:00.07

Descriptive Statistics

	Mean	Std. Deviation	N
Age	14.70	1.49	10
Cobb angle	28.10	8.48	10
2nd RPE on exertion	9.80	1.03	10
HR on exertion 2nd	136.10	10.08	10
Borg scale on exertion	2.10	.99	10
Distance 2nd test	522.00	102.83	10
2nd Peak VO2	17.24	2.57	10
Height	1.60	.07	10
SpO2 after 1st	95.90	.99	10
SpO2 after 2nd	95.30	1.42	10
Weight	47.20	7.18	10

			95% Confidence ...	76.680
q	df	S		
			Lower	
		Mean Difference		
-4.134				
Borg scale on				
Test Value = 445.32				
t				

Correlations

		HR on exertion 2nd	Borg scale on exertion	Distance 2nd test
Age	Pearson Correlation	-.15	.40	.58
	Sig. (2-tailed)	.67	.26	.08
	N	10	10	10
Cobb angle	Pearson Correlation	-.49	-.45	.37
	Sig. (2-tailed)	.15	.19	.29
	N	10	10	10
2nd RPE on exertion	Pearson Correlation	.61	.78**	-.18
	Sig. (2-tailed)	.06	.01	.61
	N	10	10	10
HR on exertion 2nd	Pearson Correlation	1	.71*	-.08
	Sig. (2-tailed)		.02	.82
	N	10	10	10
Borg scale on exertion	Pearson Correlation	.71*	1	.24
	Sig. (2-tailed)	.02		.51
	N	10	10	10
Distance 2nd test	Pearson Correlation	-.08	.24	1
	Sig. (2-tailed)	.82	.51	
	N	10	10	10
2nd Peak VO2	Pearson Correlation	-.08	.24	1.00**
	Sig. (2-tailed)	.82	.51	.00
	N	10	10	10
Height	Pearson Correlation	-.30	.19	.72*
	Sig. (2-tailed)	.40	.60	.02
	N	10	10	10
SpO2 after 1st	Pearson Correlation	-.14	.01	.10
	Sig. (2-tailed)	.69	.98	.78
	N	10	10	10
SpO2 after 2nd	Pearson Correlation	-.08	.06	.02
	Sig. (2-tailed)	.83	.88	.96
	N	10	10	10
Weight	Pearson Correlation	-.48	-.27	.62
	Sig. (2-tailed)	.16	.45	.06
	N	10	10	10

		Distance 2nd test	t	Sig. (2-tailed)
9	2.36			
		Test Value = 15.33	df	Mean Difference

		SpO2 after 2nd	Weight
Age	Pearson Correlation	.47	.41
	Sig. (2-tailed)	.17	.24
	N	10	10
Cobb angle	Pearson Correlation	.11	.43
	Sig. (2-tailed)	.77	.21
	N	10	10
2nd RPE on exertion	Pearson Correlation	-.03	-.47
	Sig. (2-tailed)	.93	.17
	N	10	10
HR on exertion 2nd	Pearson Correlation	-.08	-.48
	Sig. (2-tailed)	.83	.16
	N	10	10
Borg scale on exertion	Pearson Correlation	.06	-.27
	Sig. (2-tailed)	.88	.45
	N	10	10
Distance 2nd test	Pearson Correlation	.02	.62
	Sig. (2-tailed)	.96	.06
	N	10	10
2nd Peak VO2	Pearson Correlation	.02	.62
	Sig. (2-tailed)	.96	.06
	N	10	10
Height	Pearson Correlation	.02	.72*
	Sig. (2-tailed)	.95	.02
	N	10	10
SpO2 after 1st	Pearson Correlation	.89**	-.25
	Sig. (2-tailed)	.00	.49
	N	10	10
SpO2 after 2nd	Pearson Correlation	1	-.18
	Sig. (2-tailed)		.62
	N	10	10
Weight	Pearson Correlation	-.18	1
	Sig. (2-tailed)	.62	
	N	10	10

***. Correlation is significant at the 0.05 level (2-tailed).**

****. Correlation is significant at the 0.01 level (2-tailed).**

T-Test

Notes

Output Created		12-MAR-2021 17:44:28
Comments		
Input	Active Dataset	DataSet1
	Filter	<none>
	Weight	<none>
	Split File	<none>
	N of Rows in Working Data File	10
Missing Value Handling	Definition of Missing	User defined missing values are treated as missing.
	Cases Used	Statistics for each analysis are based on the cases with no missing or out-of-range data for any variable in the analysis.
Syntax		T-TEST /TESTVAL=90 /MISSING=ANALYSIS /VARIABLES=MaxHRbpm /ES DISPLAY(TRUE) /CRITERIA=CI(.95).
Resources	Processor Time	00:00:00.02
	Elapsed Time	00:00:00.03

One-Sample Statistics

	N	Mean	Std. Deviation	Std. Error Mean
Max HR - bpm	10	205.30	1.49	.47

One-Sample Test

				95%	
					2.35
				9	
HR on exertion	2nd RPE	Cobb	Age	Age	2nd Peak

One-Sample Test

	Test Value = 90 95% Confidence Interval of the ...
	Upper
Max HR - bpm	116.3690538

One-Sample Effect Sizes

		Standardizer[a]	Point Estimate	95% Confidence Interval	
				Lower	Upper
Max HR - bpm	Cohen's d	1.494434118	77.153	42.255	112.173
	Hedges' correction	1.635272105	70.508	38.616	102.512

a. The denominator used in estimating the effect sizes.Cohen's d uses the sample standard deviation.
Hedges' correction uses the sample standard deviation, plus a correction factor.

T-Test

Notes

Output Created		12-MAR-2021 17:44:44
Comments		
Input	Active Dataset	DataSet1
	Filter	<none>
	Weight	<none>
	Split File	<none>
	N of Rows in Working Data File	10
Missing Value Handling	Definition of Missing	User defined missing values are treated as missing.
	Cases Used	Statistics for each analysis are based on the cases with no missing or out-of-range data for any variable in the analysis.
Syntax		T-TEST /TESTVAL=93.6 /MISSING=ANALYSIS /VARIABLES=MaxHRbpm /ES DISPLAY(TRUE) /CRITERIA=CI(.95).
Resources	Processor Time	00:00:00.05
	Elapsed Time	00:00:00.07

One-Sample Statistics

	N	Mean	Std. Deviation	Std. Error Mean
Max HR - bpm	10	205.30	1.49	.47

One-Sample Test

					Borg scale on 10
10	2nd Peak	Pearson	Age	Cobb angle	-.72*

One-Sample Test

	Test Value = ...	
	95% Confide	

	nce Interval of the ...
	Upper
Max HR - bpm	112.7690538

One-Sample Effect Sizes

		Standardizer[a]	Point Estimate	95% Confidence Interval Lower	95% Confidence Interval Upper
Max HR - bpm	Cohen's d	1.494434118	74.744	40.935	108.671
	Hedges' correction	1.635272105	68.307	37.410	99.311

a. The denominator used in estimating the effect sizes.Cohen's d uses the sample standard deviation.

Hedges' correction uses the sample standard deviation, plus a correction factor.