

# Effects of Under-weighted Gait Training on Balance, Ambulatory Self-Confidence and Mental Wellness in People with Multiple Sclerosis (MS) Using the Alter G Anti-Gravity Treadmill

## 1 Abstract

Over the course of a 6-month period, participants with 3 different types of MS, regularly used the anti-gravity treadmill under the direct supervision of personal trainers and physiotherapists. Sessions were tailored to each individual with two sets of standardised exercises to be completed prior to and after the session depending on the participants main symptoms.

Over the 6 months, participants had their balance, gait, ambulatory self-confidence and perceived disability score assessed and measured at baseline, interim and final stages. They reported on their mental wellbeing at each session, and their gait, speed and distance were recorded.

On average, improvements were seen in all measured aspects for most participants, with the exception of a few outcome scores which are shown in the tables below. The most significant improvements were seen in ambulatory self-confidence, walking speed and mental wellbeing.

The limitations of this trial include the fact there was no control group for comparison of results and a relatively small participant range. 15 participants started the trial with 12 finishing the full set of sessions – producing usable data.

Overall, the conclusion was that regular use of under-weighted exercise can help people with MS in their ambulatory self-confidence, gait quality and balance. As well as speed of walking, distance walked and mental wellbeing. But further research is needed with larger patient populations.

## 2 Introduction

The MS Trust defines Multiple Sclerosis (MS) as 'a neurological condition that causes damage to the nerves in your brain and spinal cord (the central nervous system). 'Sclerosis' means scarring and refers to the damage to the nerves caused by MS. 'Multiple' is added because this can happen in more than one place.'

People living with MS can often feel symptoms of fatigue, lethargy, cognitive decline, physical deficits such as tightness and spasticity, foot drop, reduced mobility and inability to control individual limbs and movements. According to the MS Trust, it is estimated that approximately 150,000 people in the UK are currently living with MS, with a 3:1 ratio of women to men being diagnosed. While there is no cure for MS, there are several medications available that are proven to slow down the progression of certain types of MS and new medications currently in trials for the same outcome.

This project aims to look at the specific effects of under-weighted exercise on a person's physical and mental wellbeing with the aim of directing further individualised treatment plans in the future if it is proven beneficial. The project relies on participants attending regular exercise sessions using under-weighting technology to analyse and assess the impact that regular sessions can have on a person with MS. Data was collected before starting the project, at the interim point and after the final session as well as self-reported weekly assessments to generate data over the 6-month period.

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### 3 Methodology

This research project was designed as an exploratory trial to collect quantitative, objective and subjective data, through observation, questionnaires and objective assessment. We started with a null hypothesis due to the lack of research in this field with this patient population.

Data was collected using binary scores, continuous bounded at zero scores, 0-10 VAS scales and ordinal data over the 6-month period.

Written consent was gained prior to the trial starting with all participants reporting that they were able to give informed consent to the trial. It was also explained that they were able to opt out of the trial at any point or if the lead therapist thought that the trial may be unsafe to continue with, they would be withdrawn and alternative rehabilitation would be offered for the remainder of the course.

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### 4 Participants / Sample

The sample size was kept small due to the availability of the anti-gravity treadmill for this research project and the strict criteria for participation. 15 participants were selected to participate in the trial based on a range of factors including, age, type of MS, main symptoms, level of mobility and ability to commit to regular sessions over the 6-month period. All participants must have been able to mobilise either with or without a walking aid.

The ages ranged from 40-70 which included people with Primary Progressive, Secondary Progressive MS and Relapsing Remitting MS, and were split into two groups for those who had drop foot and those who did not, to distinguish between which set of standardised exercises they were going to complete both before and after their session.

At the beginning of the trial, there were 11 female and 4 male participants, however due to declining mobility in one female participant making this intervention unsafe and inability to commit to regular sessions once the trial had started by 1 female and 1 male participant – 12 participants completed the full length of the trial.

Of the remaining 12 participants, 7 had Relapsing / Remitting MS (4 Females and 3 Males). 3 had Secondary Progressive MS (3 Females) and 2 had Primary Progressive MS (2 Females).

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### 5 Data Collection Methods & Instruments

Data was collected both objectively and subjectively. Participants had their gait and balance, ambulatory self-confidence scored and their Extended Disability Status Scale (EDSS) self-assessed at the start, interim and end of the trial. Gait and Balance were assessed by a Physiotherapist using a Tinetti Test. Confidence was scored using the Ambulatory Self-Confidence Questionnaire (ASCQ) and perceived disability measured using a self-reported Extended Disability Status Scale (EDSS).

Time and distance walked during a session was recorded using the data that the treadmill saves and stores following a session.

Stress / Anxiety, Fatigue, Sleep, Pain and Mental Wellbeing were all self-reported following each session using a Visual Analogue Scale (VAS).

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## 6 Data Analysis

The questionnaires completed and scales used, provided quantitative data which was then stored and analysed and broken down into individual measures and group averages. It was also further broken down into the three different diagnoses of types of MS that were included in the study – Primary / Secondary Progressive and Relapsing Remitting.

Given the large range in final data analytics, it was decided that mean averages best represented the whole sample group to represent the outcomes of the project. The averages are displayed in the charts below and explained in the results section.

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## 7 Justifications

This Research Project is one of the only of its kind due to access to this state-of-the-art equipment and the patient population we were able to use it with. There is little research linking the effects of anti-gravity / under-weighted (including aquatic therapy) exercise and people with MS. Some of the more prevalent being; a study published in 2015 in The Journal of Sports Medicine and Physical Fitness which showed that eight weeks of water exercise helped improve quality of life and decrease perceptions of fatigue in women with MS. There was also a study published to the International Journal of MS Care in 2018 which looked at the effect of Anti-Gravity Treadmill training on Muscle Oxidative Capacity, Muscle Endurance and Walking Function in a person with MS.

This lack of research highlighted the need for a project to look specifically at physical performance and mental wellbeing with a group of participants with MS using under-weighted / anti-gravity techniques. This research has provided a key insight into some of the benefits that can be gained from using an anti-gravity treadmill over a 6-month period and how these changes can direct future treatment and structure ongoing rehabilitation plans for people with MS.

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## 8 Limitations

This study is not without limitations. The study started with 15 participants and finished with 12, which is not a representative sample of those living with MS. There was a combination of different types of MS used in this study however each diagnosis was not equally represented in the same group. Equally there was no control group used meaning there was no comparative data for those on the trial to those who were not. Hence further research with larger sample groups would be needed.

Given the variability of MS symptoms, all subjective reporting would be subject to mood and reflected in the participants' mental wellbeing scores and physical performance which can vary daily.

The initial assessments were carried out in the summer with external factors such as temperature and weather having an impact on symptoms and similarly final assessments carried out in winter with potentially the same impact.

The initial / interim / final assessments were carried out by the same physiotherapist meaning there is a lack of inter-rater reliability within the research.

Additionally, our original group was made up of 4 males and 11 females with 3 males and 9 females finishing the project. While the gender representation was not 50:50, given that the UK prevalence of diagnosis of MS in the UK is 71-72% female – our sample group is representative of the national average.

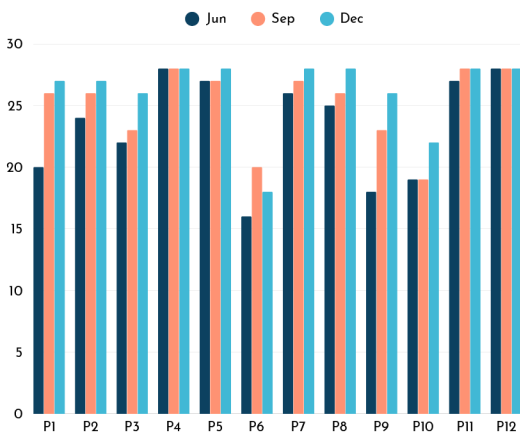
## 9 Results

Based on mean average of all participants, everyone involved in the research project that completed it, showed improvements across all measurable outcomes with the exception of pain levels which on average stayed the same – with 5 improving and 6 regressing.

The data can be summarised as follows:

1. Participants increased time on the treadmill by 51% (8.5 Minutes).
2. Participants improved by 130% (0.61km) in distance walked.
3. Participants increased their average walking speed by 55.47% (0.72kmph).
4. Stress & Anxiety + Sleep Quality improved equally by 10.55% (1.16/10)
5. Fatigue improved by 23.45% (2.58/10).
6. There were no changes in pain levels
7. Mental wellbeing improved by 2.27% (0.25/10).
8. Overall wellness improved by 29.60% (4.66/10).
9. Measurements of balance and gait improved by 14 % (3.21/28).
10. Participants reported an 18% improvement in their confidence when walking.
11. Two participants improved by 288% and 125% in their walking speed.
12. One participant reduced their speed by 24.71%.
13. One participant reported an improved confidence in their mobility of 197.5%.
14. The four participants whose confidence when walking reduced were the three male and 1 female participants – With an average of -15.89%.
15. The 9 female participants' confidence when walking improved by 55.23%.
16. One participant reported an improvement in wellness of 194.11%.
17. The 3 participants who reported a reduction in overall wellness were two males and 1 female with an average reduction of 24.14%.
18. All participants gait and balance improved by an average of 16% (Excluding the 2 participants who scored full marks at their initial and final assessment).
19. One participants' gait and balance improved by 44.44%.
20. There was a variance of 2.5 in the baseline and final EDSS scores. The most significant being from an initial score of 4 and a final score of 1.5.
21. Participants with Relapsing Remitting MS improved in all measured outcomes overall.
22. Participants with primary progressive MS improved in all measured outcomes with the exception of their EDSS score which didn't change.
23. Participants with secondary progressive MS improved in physical outcomes however scored lower in stress / anxiety, pain levels and mental wellbeing, but improved in fatigue levels and sleep quality.

## 9 Results

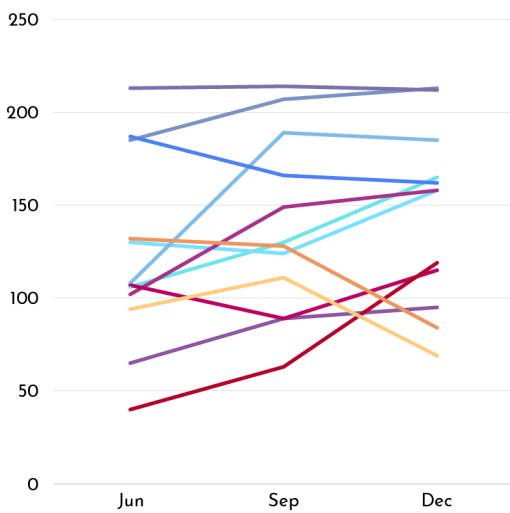


### Tinetti - Gait / Balance

Assessed by physiotherapist at the start, interim point and after the final session.

With the exception of two participants who scored fully at start and finish.

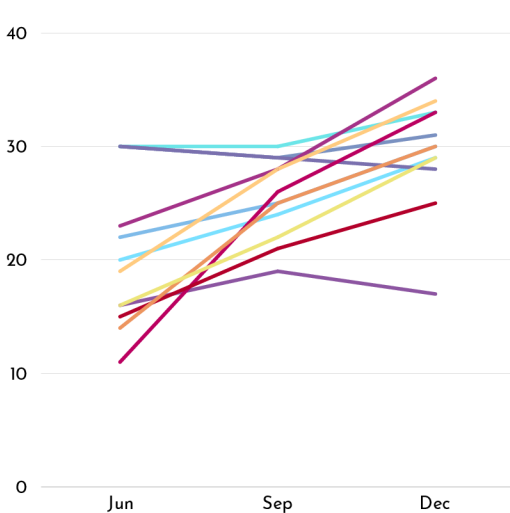
**Average: 17%**



### Ambulatory Self-Confidence Questionnaire (ASCQ)

A 22 point-questionnaire which was self-reported before the first, at mid-point and after the final session.

**Average: 25.66%**

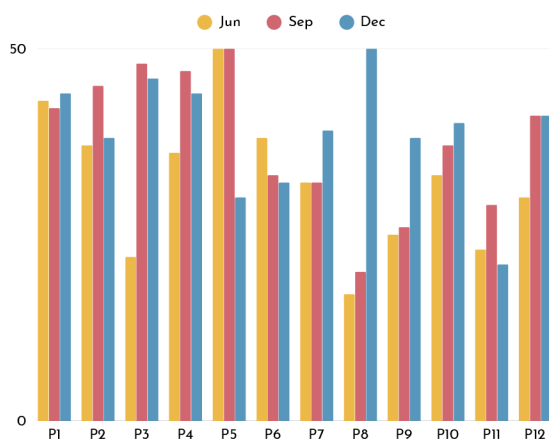


### Time on (Minutes)

Recorded at each session by the leading therapist.

**Average: 51%**

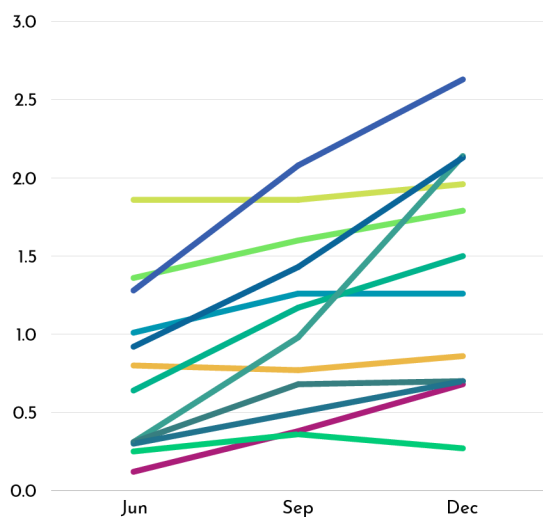
## 9 Results



### Mental Wellness

A self-reported VAS scale recorded at every session.

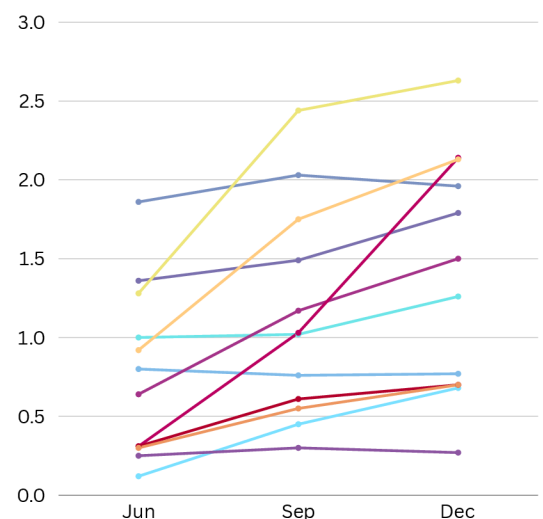
**Average: 2.27%**



### Average Speed (Kmph)

Recorded at each session by the Alter G – Anti-Gravity Treadmill and the leading therapist.

**Average: 55.47%**



### Distance (km)

Recorded at each session by the Alter G – Anti-Gravity Treadmill and the leading therapist.

**Average: 130%**

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## 10 Conclusion

This research project has shown that within our sample group that regular sessions using under-weighted exercise on the AlterG – Anti-gravity treadmill shows both physical and mental improvements for people with MS. The most significant improvements being within ambulatory self-confidence, gait and balance and overall mental wellbeing.

Though further research would be needed to make these findings applicable to a wider population, this study gives a good insight into what benefits under-weighted exercise could have on people with MS and how, over time it could improve their quality of life and overall health, wellbeing and mobility.

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## 11 Discussion

Given the limited research investigating the use of this state of the art equipment in individuals with MS, this study could provide valuable insights into the effects of regular under-weighted exercise.

As such, our aim is to adapt our service provision by introducing a block booking model within our Anti-Gravity treadmill service, helping to ensure service users can access a similar level of structured support to that delivered during the research project.

While lacking inter-rater reliability, this study provided both subjective and objective data to ensure the most accurate and reliable results were obtained throughout the 6-month period.

With the client population that completed the trial, providing usable data – We found that regular (weekly) under-weighted exercise over a 6-month period improved all measurable outcomes with the exception of pain levels. However, all other outcomes showed improvement ranging from 2.28% to 288%

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## 12 References

mstrust.org.uk – MS Trust Website

**This document can be downloaded via the MS Research and Relief Fund website at [www.msrrf.org.uk/altergresearchproject](http://www.msrrf.org.uk/altergresearchproject)**

**You will also find images and videos of the Alter G on the link above.**