

**RESPONSE TO EFFORT DURING WALKING ON
LAND AND IMMERSION IN PEOPLE WITH
DUCHENNE MUSCULAR DYSTROPHY
- CASE SERIES**

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INTRODUCTION

✓ Duchenne Muscular Dystrophy

Progressive muscle weakness

Impairment of motor function



INTRODUCTION

✓ Aquatic physiotherapy

Physical and physiological effects of immersion

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graph TD; A[Physical and physiological effects of immersion] --> B[Facilitate performance at different motor tasks]; B --> C[Decrease risk of injury];
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Facilitate performance at different motor tasks

Decrease risk of injury

INTRODUCTION

✓ Walk on immersion

Buoyancy and drag force



Decrease Weight bearing



Decrease Impact



Viscosity



INTRODUCTION

✓ Exercise intensity

Exercise intensity

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graph TD; A[Exercise intensity] --> B[Blood lactate]; A --> C[Borg Test]; A --> D[Six-minute walk test (6MWT)];
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Blood lactate

Borg Test

Six-minute walk test (6MWT)

OBJECTIVE

The purpose of this study was to analyze and compare intensity of effort in patients with DMD during six minutes walking test (6MWT) on land and immersion.

METHODS

Subjects

- DMD
- N = 6
- Male
- Independent walking
- Adaptation to the water
- Age 10-18 years

Local do estudo

- Brazilian Association of Muscular Dystrophy (ABDIM)
- Human Genome Study Center

Design

- Case series study

METHODS

Preparation for the test

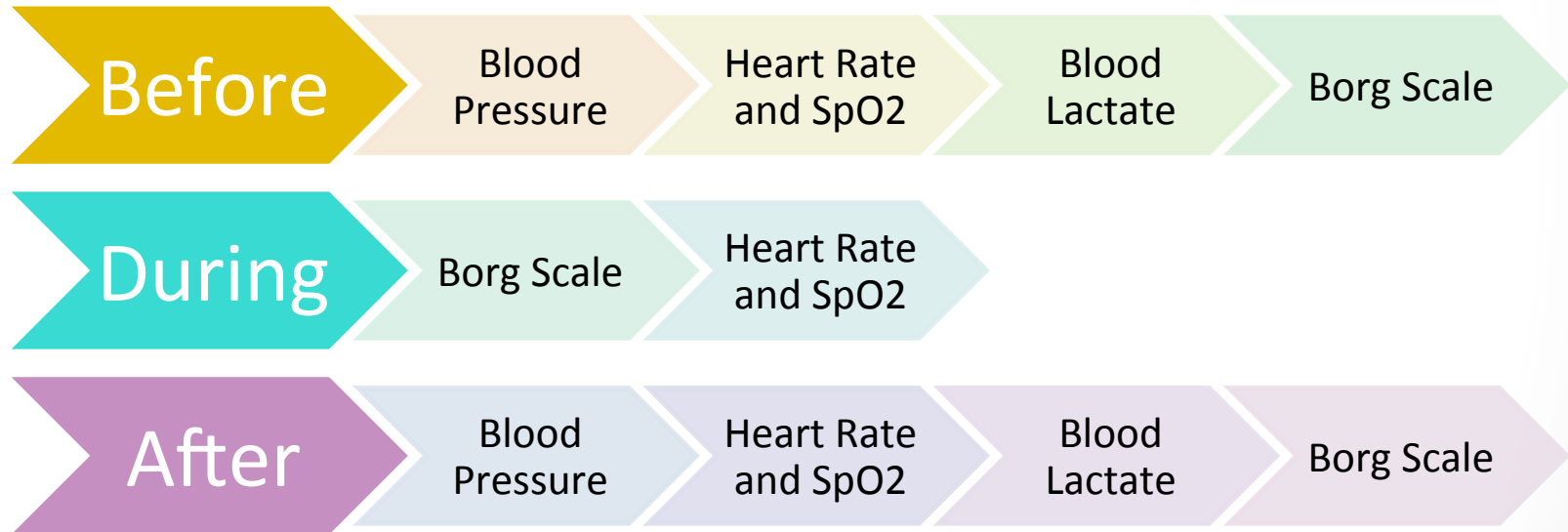
- Institutional Ethics Committee
- Juice sweetened
- 5 minutes of rest in sitting position

6MWT

- American Thoracic Society
- Six meters place
- Velocity self selected
- Controlled level of stimulus

METHODS

- ✓ 6MWT on land and immersion



METHODS

✓ Data analysis

Mean and standard deviation :

Heart rate

Blood pressure

SatO₂ (%)

Borg scale

Blood lactate

6MWT

RESULTS AND DISCUSSION

TAB. 1 Characteristic of the patients

DMD	Idade	MFM	Vignos
1	18	79.16	3
2	14	83.33	2
3	12	85.4	2
4	10	97.91	1
5	12	86	1
6	12	92.7	2
Mean	13	87.41666667	1.8333333333
SD	2.75681	6.767140213	0.752772653

RESULTS AND DISCUSSION

Step length is not increased with age, while drastically decreases cadence

D'Anglo et al., 2009

Advanced stages of the disease leads to reduced stride length.

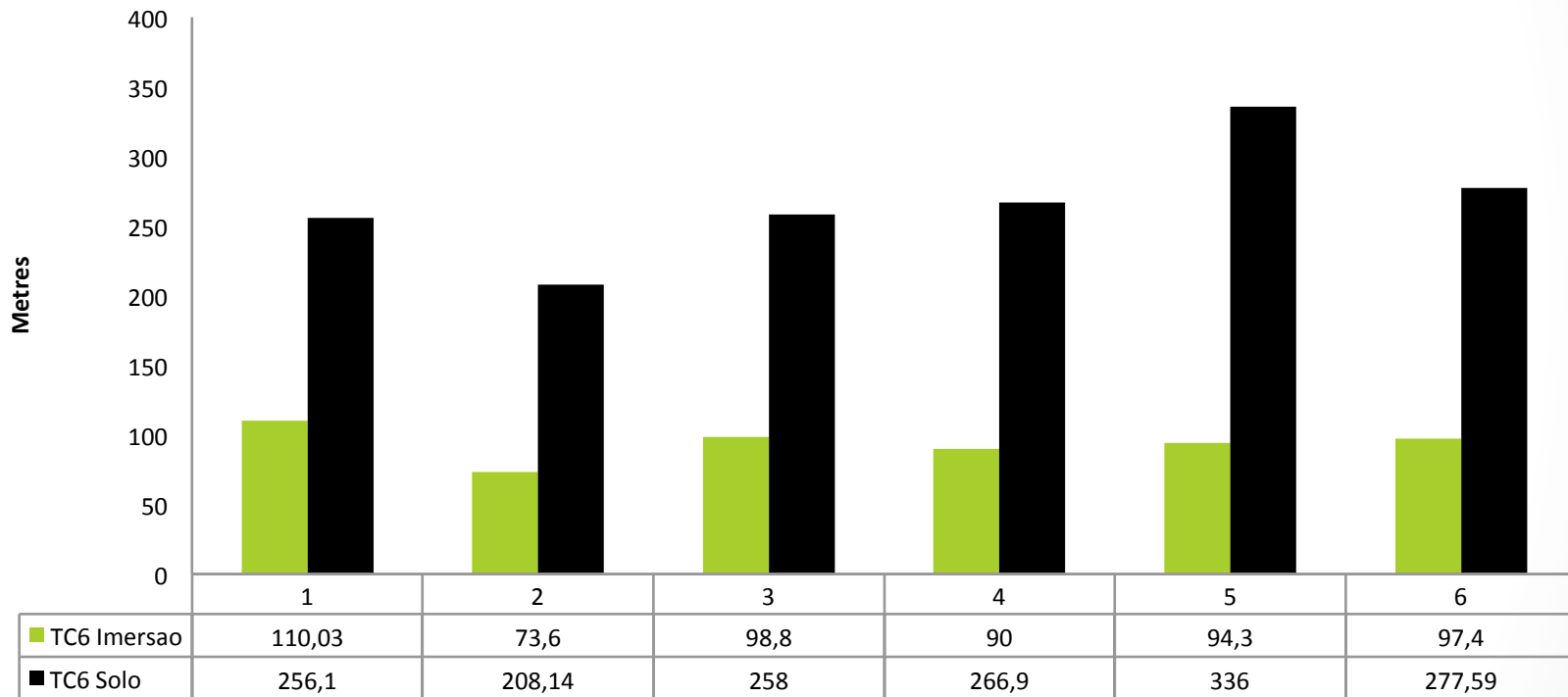
McDonald, 2009

Gait loss usually occurs when the child is between 9 and 12 years

Birkrant, 2011; Brooke, 1989

RESULTS AND DISCUSSION

6 MWT on immersion and land



Mean

Immersion: 94,02 dp 267,12

Land: 267,71 dp 41,32

RESULTS AND DISCUSSION

✓ 6MWT

McDonald, 2013

Five-year follow up, n = 57. Established the baseline of 350 meters as a the level of functional decline and mobility, and the loss of 30 meters or 10% as gait loss predictor in 4 years.

Henricson, 2012

Study with 17 patients who completed eight years and developed media of 352m. They observed that the age of 7 years is threshold to decline

McDonald, 2010

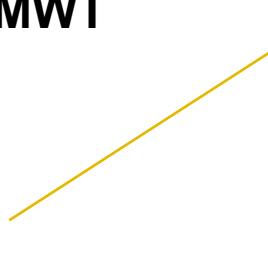
The 6MWT was chosen to demonstrate the efficacy of drug Ataluren (PTC124) in 21 DMD patients aged between 4 and 12 years. The mean distance walked of 366 m.

Mazzone, 2010

Evaluated 112 patients aged between 4 and 17 years. Observed variation in the distance from 127 to 560 m.

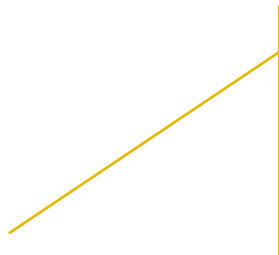
RESULTS AND DISCUSSION

✓ 6MWT



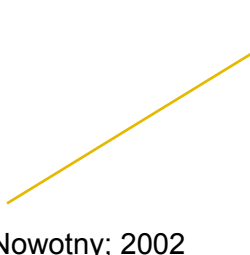
Viscosity provides greater resistance to movement as well as upthrust and drag forces acting on a body immersed in motion by modifying the execution speed and muscle strength exerted to accomplish them.

Harrison et al., 1992; Oda,
Matsumoto, 1999



Compression force on joints decreases, because of the forces that opposes the force of gravity, providing easiest movement in aquatic environment.

Barela, 2005

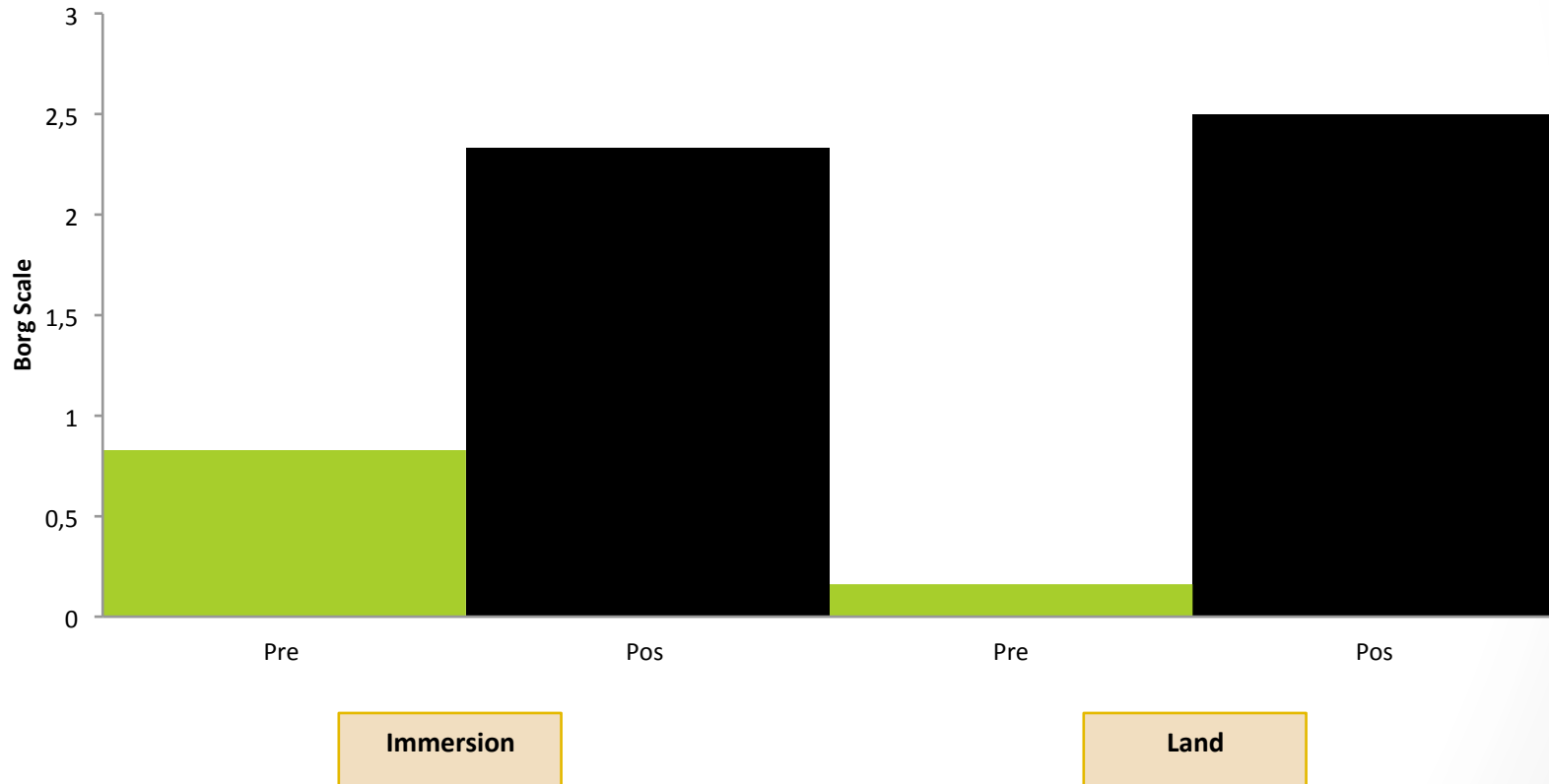


There are patients that walk more easily in aquatic environment and then transfer ability to walk on the ground.

Caromano, Nowotny; 2002

RESULTS AND DISCUSSION

6MWT X Borg Scale



RESULTS AND DISCUSSION

✓ Borg Scale

Gevard evaluated patients with DMD and concluded that intensity of perceived effort did not vary among the therapy sessions that maintained the same pattern of effort.

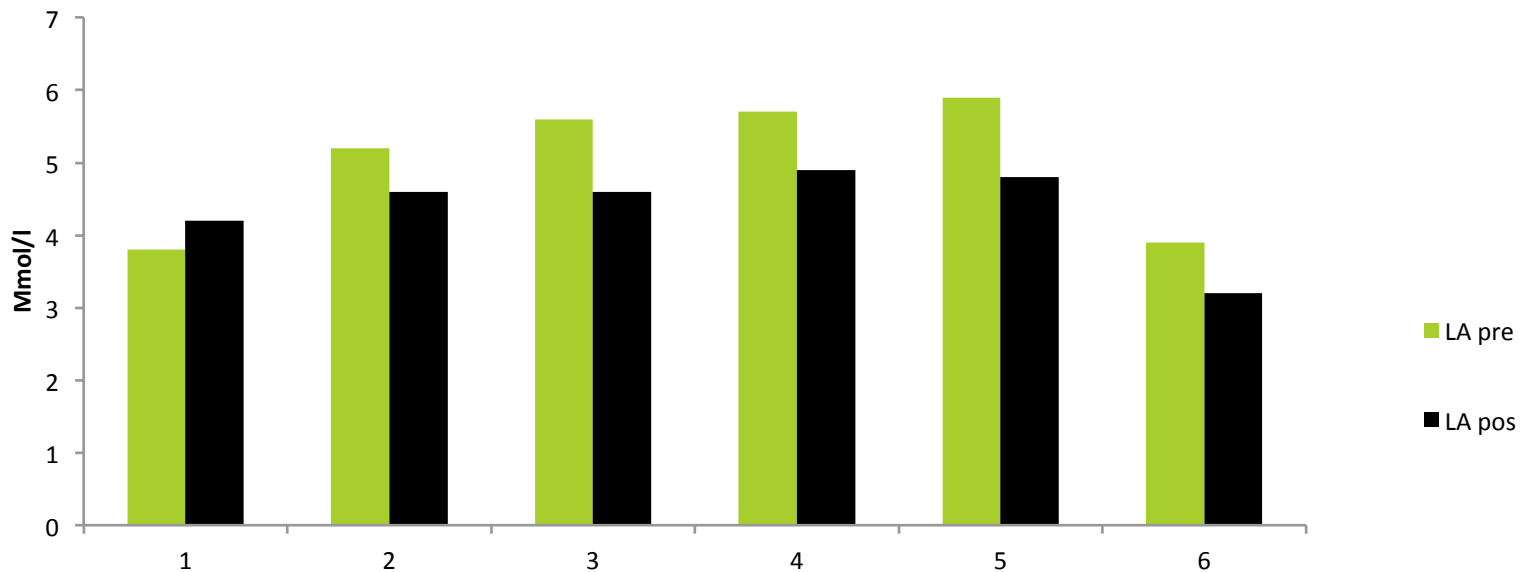
Gevard, 2011

On Borg Scale, the perceived effort responses seem to be influenced in part by psychological mechanisms added to the physiological behavior.

Graef, Krueel, 2006

RESULTS AND DISCUSSION

✓ Blood lactate (T1)



Mean

Before: 5,01 dp 0,93

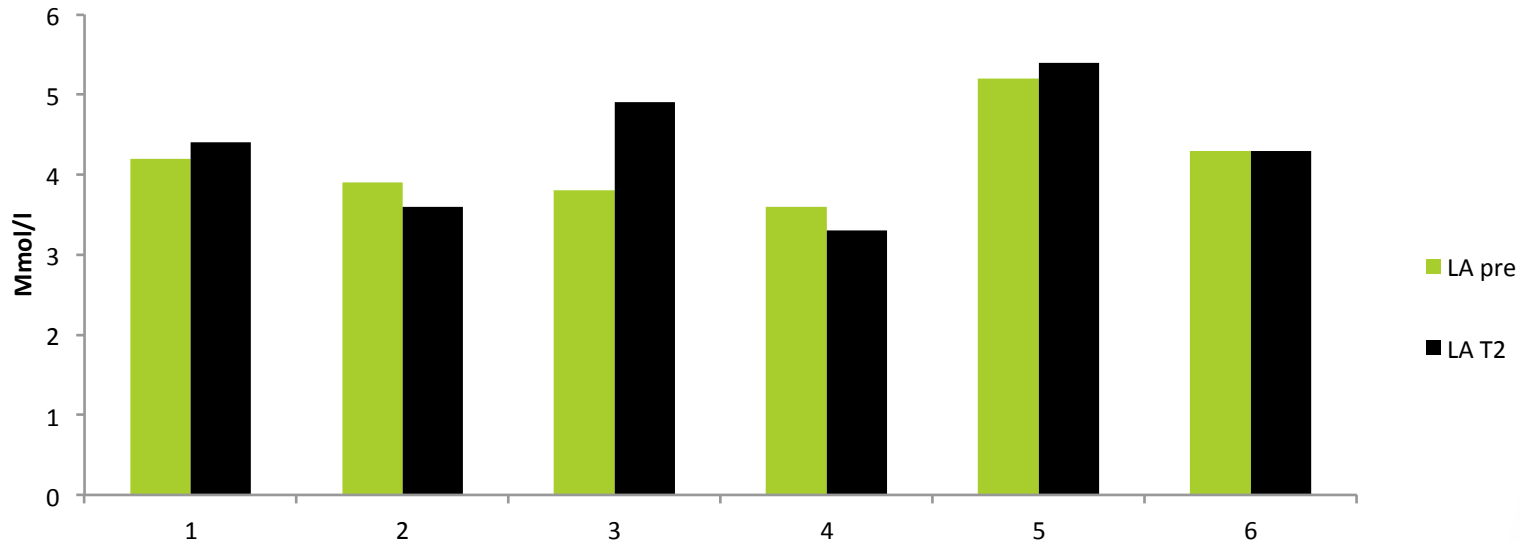
After: 4,3 dp 0,62



83,3%

RESULTS AND DISCUSSION

✓ Blood lactate (T2)



Mean

Before: 4,1 dp 0,56

After: 4,31 dp 0,78



33,3%

RESULTS AND DISCUSSION

✓ Resting Blood lactate

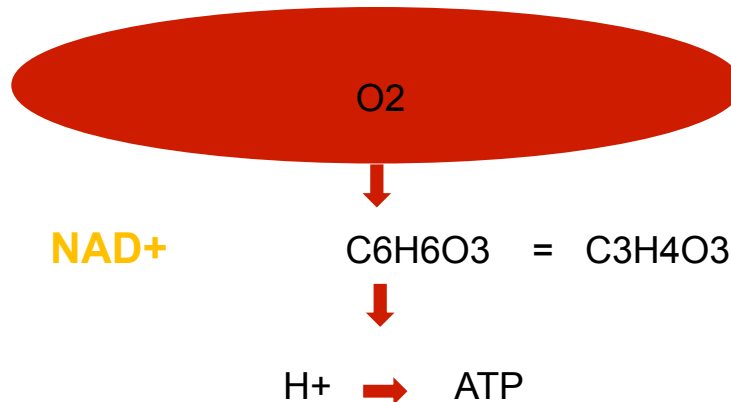
Campbel, 1989	Recommended value of lactate at rest must be less than 2.0 mmol/l.
Gevaerd, 2010	In a case study with DMD patient, lactate during physiotherapy sessions did not exceed 1 mmol/l from baseline in LA.
Santos, 2008	Excessive production of lactate is a limiting factor in physical exercises.
McArdle, 2002	When the lactate rises above 4.0 mmol/l, accumulation start in the blood and may be associated with muscle hypoxia

RESULTS AND DISCUSSION

✓ Lactate after 6MWT

Reduction of LA after exercise should be the response of oxygen during recovery or when the rhythm of activity is reduced.

Campbell, 1989



McArdle, 2002

RESULTS AND DISCUSSION

✓ Heart rate , Blood pressure and SpO₂

The oxygen saturation and BP remained stable during testing and HR increased moderately.

Safety and reproducibility

CONCLUSIONS

✓ **There was a reduction in exercise intensity immersion indicated by blood lactate**

✓ **Patients with DMD walked longest distance in 6MWT on ground**

✓ **Blood lactate and 6MWT could be an interesting measurement to explore the intensity of effort in patients with DMD, during exercises on ground and immersion**

THANK YOU

REFERENCES

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