

## VARIATION OF UPPER BODY AND LOWER BODY FORCE IN CHILDREN WITH AND WITHOUT MENTAL DISABILITY

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**ABSTRACT.** The aim of the current paper is to assess the motor quality of force, in children with and without mental disability, in order to identify its variations. Within the research, we started from the following hypothesis: mentally disabled children have reduced upper body and lower body force (as motor quality) compared to children without mental disability. The study included 35 female subjects aged between 14 and 17, with various degrees of mental disability. Measurement results show that for peak lower body force the best result was obtained by the group of children with mild mental disability. Consequently, force may not be influenced by the degree of mental disability, and this aspect should be studied in a future research.

**Keywords:** *amplitude, force, disability, Down's Syndrome*

**REZUMAT.** *Variația forței la nivelul trenului superior și a trenului inferior la copiii cu și fără dizabilitate mentală.* Prezenta lucrare are ca scop evaluarea calității motrice forța, la copiii cu și fără dizabilitate mentală, în vederea identificării variațiilor acesteia. În cadrul cercetării, am pornit de la următoarea ipoteză: copiii cu dizabilitate mentală au o calitate motrică forța pe trenul superior și pe trenul inferior mai slab dezvoltată față de copiii fără dizabilitate mentală. Am inclus în cercetare 35 de subiecți de sex feminin, cu vârste cuprinse între 14-17 ani, cu diferite grade de dizabilitate mentală. Rezultatele obținute în cadrul măsurătorilor arată faptul că, pentru forța maximă la trenul inferior cel mai bun rezultat a fost obținut de grupa copiilor cu dizabilitate mentală ușoară. Ca urmare, există posibilitatea ca forța, la această categorie de subiecți să nu fie influențat de gradul dizabilității mentale, aspect care ar trebui cercetat într-un studiu ulterior.

**Cuvinte-cheie:** *amplitudine, forță, dizabilitate, Sindrom Down.*

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## Introduction

The incredible possibilities of disabled people, as well as their permanent desire to better themselves, corroborated with the competition drive specific to humans, determined a reorientation of motor activities toward sports activities adapted to disabled persons (Năstase, 2003). In the scientific literature, there are specific terms for persons deviating from normality (as general signification), regarding the entire psychophysical development, because several physical, motor, sensory, or mental aspects are delayed. Hence, "normal" would mean properly adjusting to the environment and relating to the peer group and cultural environment; "abnormal" includes deviations from the standard, insufficiencies, development retardation, as well as physical, behavioural, sensory conditions, etc.(Pásztai, 2006).

## Hypothesis

Within the research, we started from the following hypothesis: mentally disabled children have reduced upper body and lower body force (as motor quality) compared to children without mental disability.

## Methods and materials

The study included 35 female subjects, aged between 15 and 17, with various degrees of mental disability (Table 1).

**Table 1.** Repartition of subjects per educational establishments

<i>No.</i>	<i>Educational establishment</i>	<i>No. of subjects</i>	<i>Case observation</i>
1.	"G. Ibrăileanu" High-school in Iași	10	Without disability
2.	"Sf. Andrei" School in Gura Humorului	10	Mild mental disability
3.	"Laurenția Ulici" Foster Care Centre in Gura Humorului	10	Several mental disability
4.	"Constantin Păunescu" School Iași "	5	Down's Syndrome

The tests were applied in the kinesiotherapy practices of the "Sf. Andrei" School in Gura Humorului, of the "Laurenția Ulici" Foster Care Centre in Gura Humorului, and of the "Constantin Păunescu" School Iași. We also used the gymnasium at the "G. Ibrăileanu" High-school in Iași. For measuring upper body and lower body force, we used two tests, as follows:

1. From plank position, we counted the number of push-ups executed in 30 seconds.

Force represents the property of the locomotor system of overcoming various external resistances or even the weight and inertia of body parts, by moving its segments following muscle contraction (caused by the activity of the nervous

system). This biological definition is completed by the mechanical–physical notion of force, which represents the value of the product between mass and acceleration ( $F = m \times a$ ) which in essence expresses the modification of the body's motion state and even previous form (Ifrim, 1986).

2. From sitting, we counted the squats executed for 30 seconds.

Concerning the morphophysiological substrate ensuring force, there are two main segments of the body, besides the activity of the other systems:

- I. The nervous system;
- II. The muscle system.

**I. The nervous system** acts through two main mechanisms:

**A. Setting in motion as many motor units as possible**

A motor unit is the formation comprised of the peripheral motor neuron and its dendrites and its prolongation, the axon, and corresponding neuromotor plaques, along with all muscle fibres that it innervates. It is known that, at rest, 2–5% of the units are in contraction; during minimal efforts, 10–30%; during intense efforts, 40–60%; during sports performance activity, 70–75%.

Setting in motion as many motor units as possible depends on the capacity of the motor neural cortex and of the pyramidal area of sending as many and as precise nervous impulses that determine the depolarization of motor units.

**B. Unitary assembling of active motor units**

Central nervous system (motor cortex) is the one that synchronizes the functionality of motor units because they initially act under various circumstances concerning their degree of contraction; subsequently, by increasing the nervous impulses to 45–50/sec., maximal contraction force is achieved (Ifrim M., 1986).

**II. The muscle system** is the second main element that conditions force.

It is known that force developed by a muscle is directly proportional with its physiological section. Hence, increasing the physiological section and muscle hypertrophy, respectively, is one of the ways of developing force (Ifrim M., 1986). We processed the statistical results using SPSS 13 for Windows.

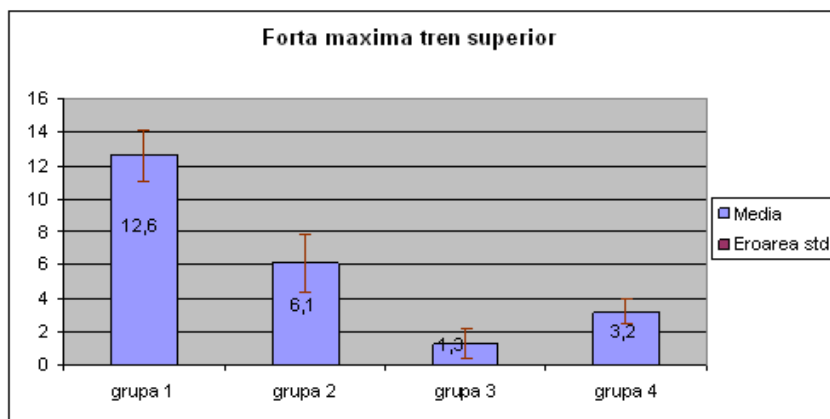
## **Findings and discussions**

### **A. Results for peak upper body force**

As illustrated in Fig. 1, the mean values of the four groups range between 1.3 for the group of children with severe mental disability and 12.6 for the group of normal children.

After calculating the means for peak upper body force, statistically significant differences were found between the group of normal children and the group of children with severe mental disability and between the group of normal children

and the group of children with Down's Syndrome (9.4), for  $p \leq 0,001$ . A significant difference was also highlighted between the group of normal children and the group of children with mild mental disability. The value of this difference is 6.5 repetitions and it is highly statistically significant ( $p < 0.02$ ).



**Fig. 1.** Mean values and standard errors of the four groups for peak upper body force

After analyzing the variation coefficient – ranging between 39.45% and 214.68%, it can be stated that the four groups are heterogeneous. (Table 2).

**Table 2.** Characteristics of peak upper body force in children with and without mental disability

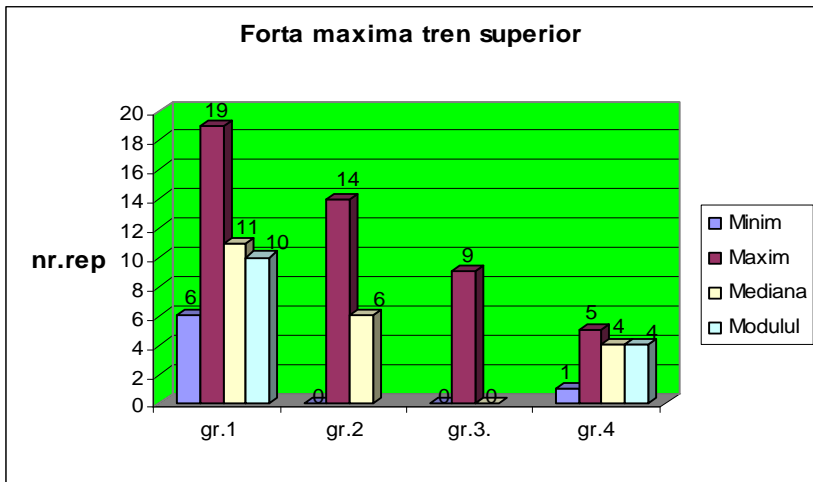
Group	N	M	M%	Std. E.	V. C.%	t	p
Group 1	10	12.6	100%	1.571	39.45	2.782	0.012
Group 2	10	6.1	48.41%	1.728	89.61		
Group 1	10	12.6	100%	1.571	39.45	6.268	p<0.001
Group 3	10	1.3	10.31%	0.882	214.68		
Group 1	10	12.6	100%	1.571	39.45	5.417	p<0.001
Group 4	5	3.2	25.39%	0.734	51.35		
Group 2	10	6.1	48.41%^	1.728	89.61	2.473	0.027
Group 3	10	1.3	10.31%	0.882	214.68		
Group 2	10	6.1	48.41%	1.728	89.61	1.544	0.149
Group 4	5	3.2	25.39%	0.734	51.35		
Group 3	10	1.3	10.31%	0.882	214.68	1.391	0.123
Group 4	5	3.2	25.39%	0.734	51.35		

The dispersion values for the entire series vary between a minimum of 0 repetitions for the group of children with mild mental disability and the group of children with severe mental disability, and a maximum of 19 repetitions, recorded for the group of normal children (according to Table 3).

**Table 3.** Central and dispersion values of peak upper body force for the four groups

Peak u.b. force	<i>gr.1</i>	<i>gr.2</i>	<i>gr.3.</i>	<i>gr.4</i>
<i>Minimum</i>	6	0	0	1
<i>Maximum</i>	19	14	9	5
<i>Median</i>	11	6	0	4
<i>Module</i>	10	0	0	4
<i>Mean</i>	12.6	6.1	1.3	3.2
<i>Amplitude</i>	13	14	9	4

The highest amplitude (14 repetitions) is recorded in the group of children with mild mental disability (according to Fig. 2).

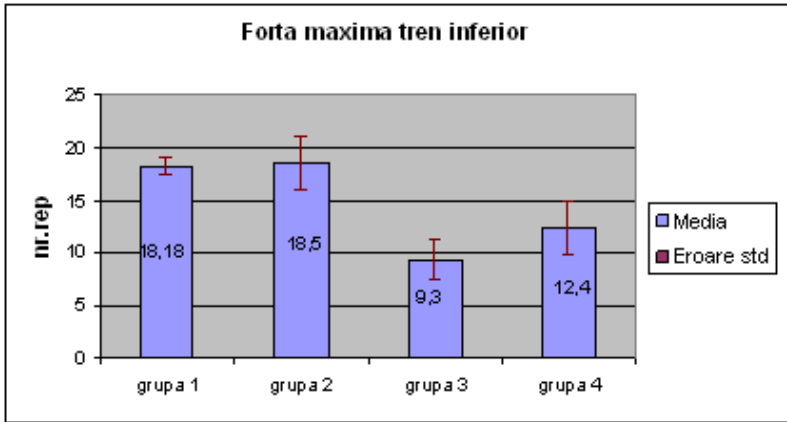


**Fig 2.** Minimum, maximum, median, and module values in the four groups for peak upper body force

### ***B. Data on peak lower body force***

As shown in Fig. 3, the values of lower body force are very close for the group of normal children (18.18 repetitions) and for the group of children with mild mental disability (18.5%). The difference is in favour of the group of

children with mild mental disability, that is 0.32, and it is not statistically significant. The greatest difference is recorded between the group of children with mild mental disability and the group of children with severe mental disability.



**Fig. 3.** Mean values and standard errors of the four groups for peak lower body force

It has the value of 9.2 repetitions and it is statistically significant, for  $p \leq 0.01$ . Another highly statistically significant difference was found between the group of normal children and the group of children with severe mental disability – 8.88 repetitions – for  $p \leq 0.001$  (according to Table 4).

**Table 4.** Characteristics of peak lower body force in children with and without mental disability

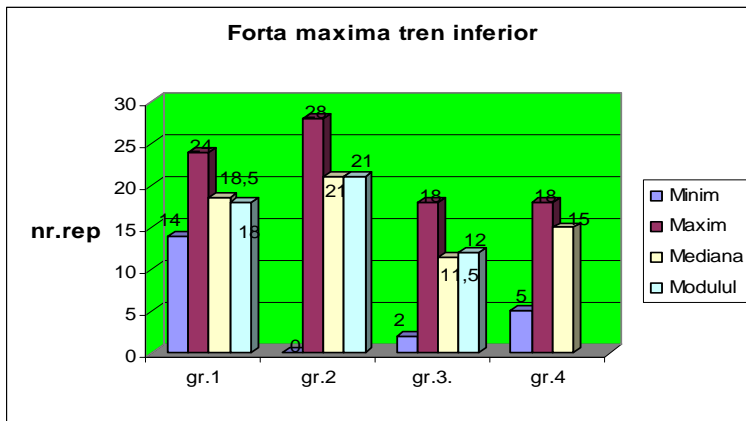
Group	N	M	M%	Std. E.	V. C.%	t	p
Group 1	10	18.8	100%	0.879	14.79	0.111	0.913
Group 2	10	18.5	98.40%	2.552	43.64		
Group 1	10	18.8	100%	0.879	14.79	4.554	0.001
Group 3	10	9.3	49.46%	1.891	64.33		
Group 1	10	18.8	100%	0.879	14.79	2.413	0.06
Group 4	5	12.4	65.95%	2.502	45.12		
Group 2	10	18.5	98.40%	2.552	43.64	2.895	0.01
Group 3	10	9.3	49.46%	1.891	64.33		
Group 2	10	18.5	98.40%	2.552	43.64	1.505	0.156
Group 4	5	12.4	65.95%	2.502	45.12		
Group 3	10	9.03	49.46%	1.891	64.33	0.965	0.352
Group 4	5	12.4	65.95%	2.502	45.12		

The only homogenous group is the group of normal children, with VC = 14.79%. The other groups are heterogeneous; the value of the variation coefficient ranges between 43.64% and 64.33%.

For the entire series, dispersion varies between a minimum of zero, recorded for the group of children with mild mental disability (this group also records the maximum value of 28 repetitions, according to Table 5). As illustrated in Fig. 4, the highest amplitude was also scored by the group of children with mild mental disability.

**Table 5.** Central and dispersion values of peak lower body force for the four groups

F.max inf	gr.1	gr.2	gr.3.	gr.4
<i>Minim</i>	14	0	2	5
<i>Maxim</i>	24	28	18	18
<i>Mediana</i>	18.5	21	11.5	15
<i>Modulul</i>	18	21	12	*
<i>Media</i>	18.8	18.5	9.3	12.4
<i>Amplitudinea</i>	10	28	16	13



**Fig. 4.** Minimum, maximum, median, and module values in the four groups for peak lower body force

## Conclusions

Consequently, force may not be influenced by the degree of mental disability, and this aspect should be studied in a future research.

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