DISTRIBUTION OF THE ROTATION FORCE OF GRAVITY POSITION COP IN SAGITTAL PLANE IN THE GROUP OF HEALTHY CHILDREN AND MENTALLY DISABLED WITH SLIGHT PARTICIPATING IN 10-WEEKS CLASS EQUESTRIAN

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- balance,
- sagittal plane,
- position of center gravity,
- position of pressure,
- mental retardation,
- slight,
- plane of support,
- horse riding,
- hippotherapy.

Abstract:

Man maintaining balance upright performs random movements, resulting from the instability of pillared body in two points. Those are tracking movements of the underlying motility which is maintain the body balance. A feature of balance control system is a choice of strategy or a way of behavior in response to stimuli and restore the balance of coordinated muscle activity by stabilizing an ankle joint and hip tibia making movements in the frontal and sagittal plane.

In order to determine nature and quality of changes in the distribution of stabilographic parameters in sagittal plane under an influence of equestrian activities measured range, minimum, maximum and average values of the position of center gravity position, pressure of COP in a sagittal plane Y in the group of healthy children and mentally disabled with slight participating in 10 weeks of equestrian classes three times a week for 30 minutes. Measurements of equivalent were used by stabliographic platform. Measurements were made before start of the course and after with a group of healthy children and mentally disabled made on 28 persons. Statistically significant positive changes were observed in the distribution of all measured parameters in both healthy and disabled children with slight mental, but in a group of healthy children differences were highly statistically significant. The impact of horse traffic shaping responses equivalent in sagittal plane in the group of children between aged 15-17 years by introducing statistically significant, positive changes. Improving the response of equivalent size in sagittal plane is so important because it improves control of balance in the plane in which range of motion in joints of lower limbs is better.

INTRODUCTION

Multi segment structure of human body and its considerable height in relation to support of a small plane that makes standing position is only conditionally stable and must be constantly monitored. Such continuous postural balance control is in a sense, kind of dialogue with the environment of nervous system. It is generally believed that behavior is result of a balance between the activity of opposing muscle groups stabilize individual joints. For proper body balance in the incidence of free standing vertical projection of the center of gravity in the middle area of supporting surface. A healthy person standing motionless outside your

consciousness takes small oscillations called roll attitude [1,4,5,8]. Man holding while standing upright posture tends to equilibrium constant, but it never reaches, and postural control in an area characterized by the process of vibrational stability in erect posture projection of the center of gravity of human body is a small, well-defined area foothold. This area is located approximately 5 cm forward from the ankles lateral tibia-ankle joints. In fact, a means of pressure on substrate of interest (COP) of the person performing both feet can move freely about 0.4 cm in the sagittal plane and about 0.18 cm in the frontal plane [12].

While balancing upright man stabilizes movement in all joints, in addition to jump-tibia joint so that the body conformed to a rigid body. Changed are dependent on the so-called muscle work antigravity responsible for maintaining proper body position. In the sagittal plane muscle quickly change their stress on the ankle, causing changes in tension in the joint capsule [4,8].

Three-dimensional movement of horse allows the rider to experience in a specific functional movement patterns. The rhythmic movement of horse also produces rhythmic stabilization of pelvis and trunk rider [9,11]. One of the movement are movements in the sagittal plane, which are similar in humans and horses, in timing and duration of the sequence. Alternately, there are accelerations that occur when taking your foot off the ground and lift up and braking at the time of placing their feet on the ground. They fit rider moves forward and backward. This happens regardless of comorbid at this point, carrier forces of progression and dependent direction of the centrifugal force and centripetal. Movements of pelvis in the sagittal plane in a horse held for 3.92º, 5º man [3]. Position the pelvis has a significant effect on the whole body, as by the support surface pulses are transmitted from the horse's movement by stimulating body to correct responses equivalent. No pond is not in closed position (locked) and it is possible to absorb movements horse economical and optimum equilibrium reaction [10].

Both, healthy children and mild mentally disabled can become the subject of a positive impact of moving horse, although mental retardation, psychomotor development impoverishes adequate to degree of disability. The immediate cause of mental retardation in damage to the central nervous system, therefore, children with mental disabilities have impaired motor development, remaining in close connection with their mental development, and one of the components of this development is a process of development as a component of equivalent response coordination [2.6].

Functional state of human balance organs can be described by stabile-metrical platform, which is movement of subject's center of gravity such as Y in the sagittal plane to the front (+Y) and backward (Y). Projection of the center of pressure on foot substrate is thus recorded as a dynamic parameter and a changing position in the unit time.

PURPOSE AND SCOPE OF WORK

Analysis of problem concerns regulation of equivalent reactions of 28 people with mild mental illness and28 healthy children, participating in equestrian activities. The aim of article is to analyse changes in distribution of the position of center gravity position of the pressure in COP in the sagittal plane as a result of lessons riding as an alternative form of reaction formation equivalent as a part of the coordination capacity of determining the performance of motor actions.

MATERIALS AND METHODS

The research group was 28 children between 15-17 aged participated in hippotherapy classes in an equestrian center "Equistro" in Wierzawice for a period of 10 weeks, three times a week for 30 minutes, while a group of healthy young people held the same program in the School Equestrian Club in Nawojowa (Table 1).

Table 1. Description of groups participating in activities

Hippotherapy group	Weight (kg) $\bar{x}$	Height (cm) $\bar{x}$	Quantity
U- handicapped children with slight mental	60,3	164,8	28
Z- healthy children	58,4	170,1	28

The equestrian activities developed according to Polish Association of Hippotherapy and Polish Equestrian Federation. Activities include horseback riding rein in the correct riding posture and exercises while riding equivalent to "stand" and while driving rein. The statistical analysis program selected parameters Baby Soft for balance, recording natural center of gravity. Statistical analyzes were performed using Statistica 8 used descriptive statistics recorded variables. An analysis of distribution of the studied traits, which pointed to the lack of normal distribution and homogeneity of variance. Therefore, to detect significant changes in intra - Wilcoxon test was used for dependent samples through tests performed twice before scheduled classes and after 10 weeks. Based on the measurements characterized by:

-COP-Y Avg (cm) – average position of the center of gravity of load position of the COP in sagittal plane Y

-COP-Y Max (cm) – maximum pressure position of the center of gravity position of the COP in sagittal plane Y

-COP-Y Min (cm) –minimum pressure position the center of gravity position of the COP in sagittal plane Y

-Max COP-Y-COP-Y Min (cm) - scope sway stabilo-gram curve in sagittal plane Y and distribution of performance measure in the form of a histogram.

RESULTS AND DISCUSSION

Analysis stabilographic parameters derived from tested groups before and after the course, equestrian pointed to the improvement of all parameters in the group of healthy children. In the group of mentally handicapped children with slight three out of four respondents indicate improved performance equivalent reactions: average and maximum pressure position of the center of gravity position of the COP in sagittal plane Y and sway range (table 2).

Table 2. Stabilographic parameter values before and after school equestrian in healthy adolescents (Z) and mentally handicapped with slight (U) (*statistically significant differences-Wilcoxon test, p <0.05)

Research group	Parametric stabilografic		**COP-YAvg (cm)**	**COP-YMax (cm)**	**COP-YMin (cm)**	**COP-YMax-COP-YMin (cm)**
Z	$\bar{x}$	Bad.1	-4,65	4,85	-1,53	6,38
		Bad.2	-2,88	3,57	-1,23	4,80
	Me	Bad.1.	-5,15	5,44	-1,37	6,68
		Bad.2.	-2,91	2,94	-1,01	4,41
	S	Bad.1.	1,84	1,93	0,56	1,90
		Bad.2.	1,57	2,36	0,64	2,35
	Min	Bad.1.	-7,85	0,56	-3,22	1,61
		Bad.2	-5,84	0,64	-3,12	1,34
	Max	Bad.1	-0,45	8,31	-0,82	9,35
		Bad.2.	0,61	8,98	-0,63	10,16
	p		**0,0001*** **	**0,0043** **	**0,0148***	**0,0026** **
U	$\bar{x}$	Bad.1	-5,20	5,20	-1,66	6,86
		Bad.2.	-4,01	4,20	-1,65	5,85
	Me	Bad.1	-4,71	4,71	-1,55	6,38
		Bad.2	-3,97	3,97	-1,53	5,71
	S	Bad.1	2,32	2,32	0,51	2,62
		Bad.2	2,09	1,78	0,67	2,01
	Min	Bad.1	-10,96	1,47	-2,93	2,72
		Bad.2	-7,71	1,01	-3,47	2,42
	Max	Bad.1	-1,47	10,96	-0,70	13,37
		Bad.2	0,80	7,71	-0,52	9,85
	p		**0,0125***	**0,0239***	0,5481	**0,0366***

Distributions rates average position of the center of gravity position of the COP pressure in both groups show an improvement in performance values. In the case of a group of healthy children the greatest improvement was observed in the range of 0,0-1,0cm sway of 0.0% to 4.0%, in the range of sway (-1.0) - (-2.0) cm, which was the most dynamic change in value (4% and 27%). Decreased distribution of the extreme values of this parameter as a result of equestrian activities in the range of (-8.0) - (-6.0) cm indicating the improvement of distribution of the range sway in the sagittal plane(Fig. 1).

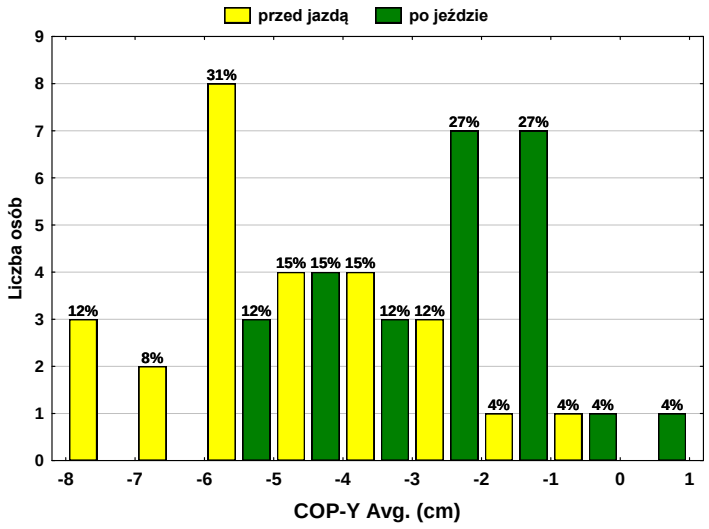

Fig. 1. Distribution of COP-Y Avg before and after class equestrian group of healthy children

A similar trend of changes in the distribution of extent changes observed in the group of mentally handicapped children with slight. Following experience of riding difference between extreme values of sway (-12) - (-8) cm was reduced in favor of the distribution of intervals with lower values (0,0-2.0 cm from 0% to 4%, 0.0 -2,0 cm of 7% to 11%) (Fig. 2).

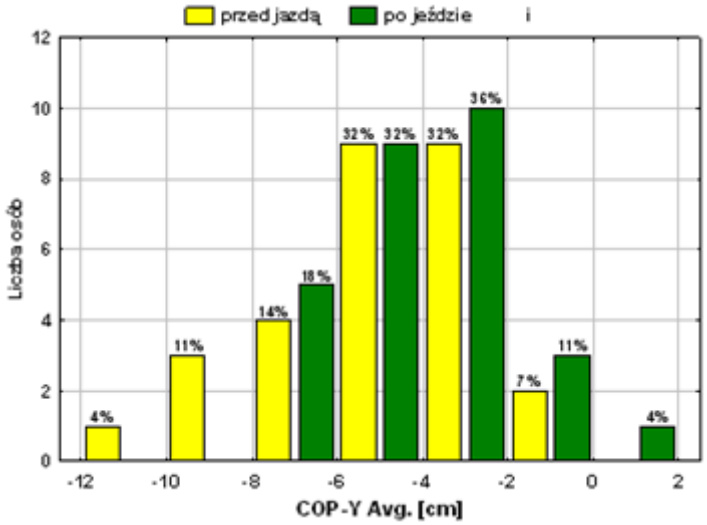

Fig.2. Distribution of COP-Y Avg before and after class equestrian group of mentally handicapped children with slight

A similar trend changes represent a change in the position of the maximum pressure position the center of gravity of the COP in the frontal plane X. The distribution of values of this parameter in the range of 0,0-1,0 cm measured before and after the classes held, was represented in the group of healthy children respectively by 4 and 12% of those in the group of handicapped children, the low value of range was not represented. Range of 1.0-2.0 cm was numerously represented in the test healthy children after completing the course (4 and 27%). A large positive change was observed in the range of 2.0-3.0 cm decomposition in both healthy children (12 and 19%) and the mentally retarded (4 and 21%). In both groups, equestrian activities led to improvement of the extreme valuesin ranges 8-11cm (fig.3, 4).

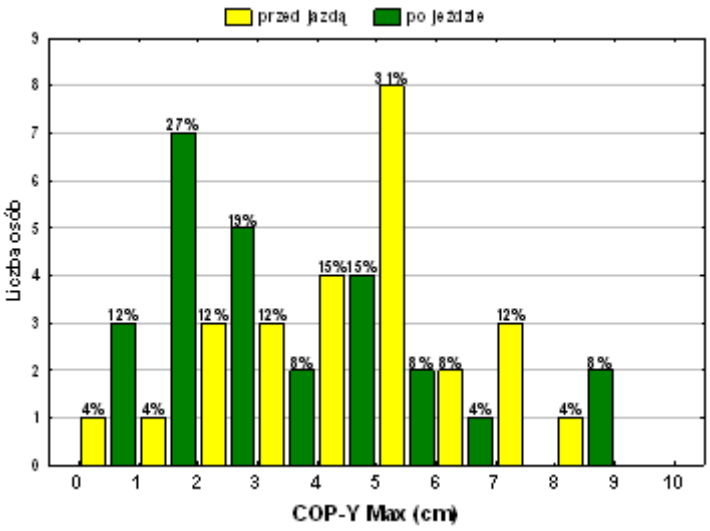

Fig. 3. Distribution of COP-Y Max before and after class equestrian group of healthy children

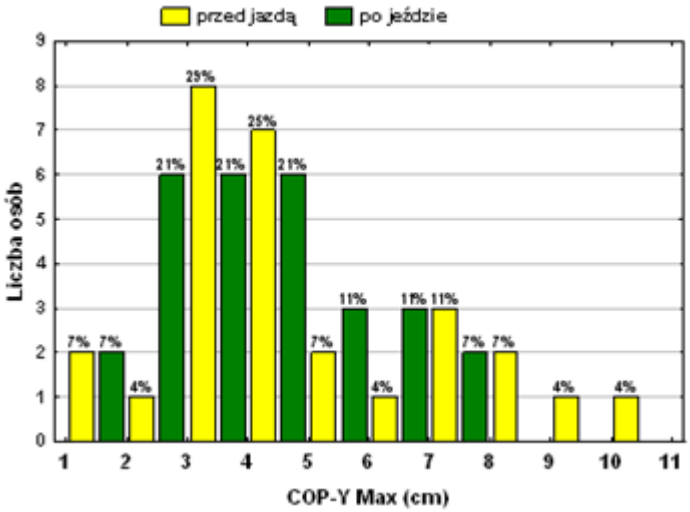

Fig. 4. Distribution of COP-Y Max before and after class equestrian group of mentally handicapped children with slight

In the case of distribution range of curve stabilo-gram sway in sagittal plane in a group of healthy children share of individuals with parameters in the range of 1,0-6,0 cm, because in each of them there is a more smaller percentage of parameter value. Particular improvement was noticed in the range of 1.0-2.0 cm (4 and 12%), 2.0-3.0 cm (0-15%) (ryc.5).

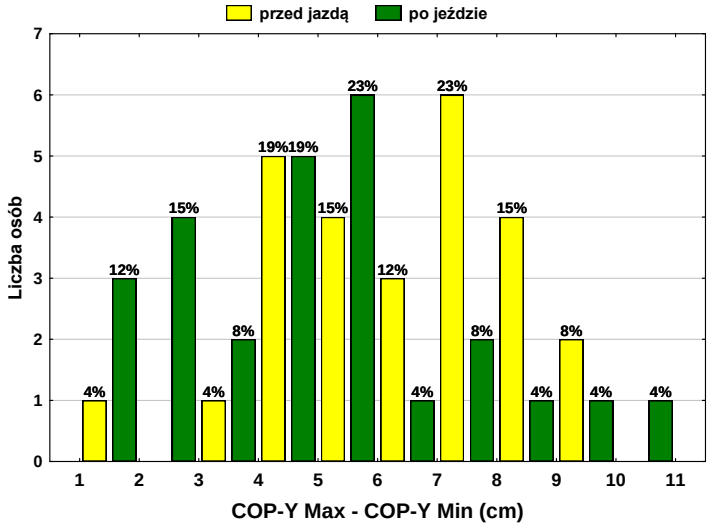

Fig.5. Distribution of COP-Y Max-Min COP-Y before and after class equestrian group of healthy children

In the group of mentally handicapped children with slight, participation in horse riding meant that more children were characterized by lower values of distribution ranges sway yield the greatest change in the range of 2.0-4.0 cm (11 and 18%). After the end of the day there were no extreme values for large values of10,0-14,0 cm (Fig. 6).

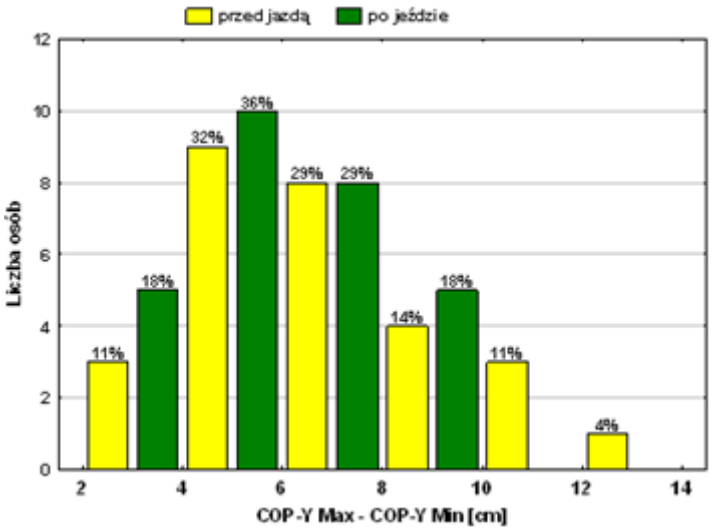

Fig. 6. Distribution of COP-Y Max-Min COP-Y before and after class equestrian group of mentally handicapped children with slight

The last test parameter, minimal pressure position center of gravity position of the COP in sagittal plane Y was significantly improved only in the group of healthy children. Distribution of this ratio indicates an increase in the share of children between the minimum (-0.5) - (-1.0) cm (12 and 46%) and a low proportion of children in periods of maximum (-2.5) - (-3 , 5) cm. A different situation was observed in the group of mentally handicapped children with slight, where different classes of decomposition show an improvement of this indicator (ryc.7, 8).

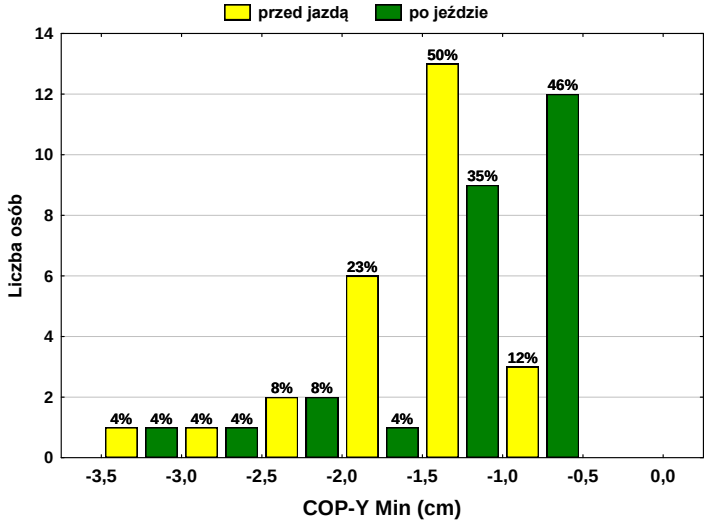

Fig. 7. Distribution of COP-Y min before and after class equestrian group of healthy children

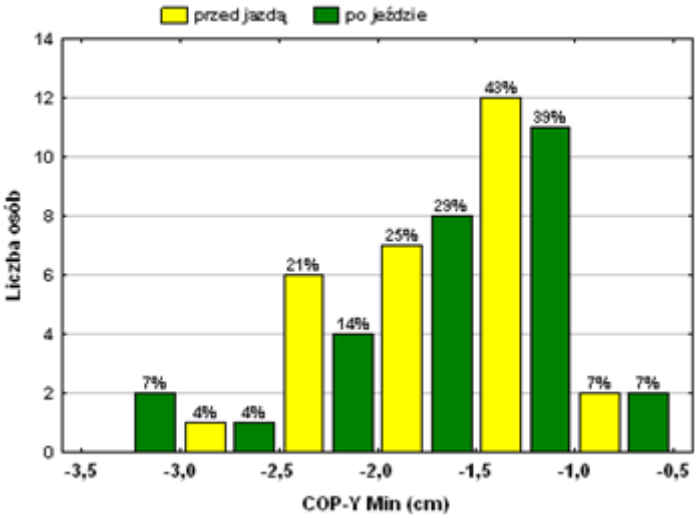

Fig. 8. Distribution of COP-Y min before and after class equestrian group of mentally handicapped children with slight

SUMMARY AND CONCLUSIONS

Control of balance is based on the information from muscle receptors, which are sensitive to voltage change and length of each muscle and nervous system indicate speed with which is muscle tension or stretching. The joint receptors, joint capsules and tendon in tendons and ligaments also play a significant role in maintaining body posture. In the case of lower limb, the information about minimal changes in the ankle joint angles is of a paramount importance for postural control centers [1,12]

Feet, which the human body is based on, form a mechanical system, which is quite different in a sagittal plane than in a frontal one. If the system is considered in sagittal plane, it can be assumed that the body is supported at one point, and the point of application of force (reaction force) on the substrate is disposed at a distance from the fulcrum of body and is symmetrical movement of center of gravity for the both legs simultaneously. As a result of such a mechanical system other stabilographic parameter values occur in a sagittal plane. In sagittal plane foot traffic creates a two-way lever, where the axis of rotation are hocks and there are two moments of power: muscle and gravity, which is not always balanced and easier to lose your balance. During oscillation center of gravity to the left or right of vertical projection is always between hocks, and control of center of gravity oscillations in sagittal plane requires more effort on the part of muscular and ligamentous-joint [7].

As a result of riding, improvements of all parameters such as average, maximum and minimum pressure position of center of gravity position of the COP in sagittal plane Y and scope sway in a group of healthy children were observed. It should be noted that statistical significance of changes was high, except for location of minimum pressure position center of gravity. A group of slight mentally handicapped children after 10 weeks of riding also has improved performance, but with a lower level of significance, except for absence of a change in the minimum position of center of gravity position of the COP pressure. Schedule changes of individual parameters pointed at the increase in the number of smaller size class values, and reduction of stress class intervals of maximum values for each parameter, which indicates the improvement in equivalent. The power of equivalent reaction changes between healthy and slight handicapped children makes a fundamental differentiation between responses of the nervous system that has some dysfunction in children with disabilities.

Treatment and control of body balancing on horseback in sagittal plane is musculo-ligamentous system, making it possible to control more sway in the sagittal plane than the frontal one. The pelvis is capable of affecting the balance for a subsequent lower limb joints.

Feet play an important role in the control of the movement in sagittal plane than the front and lift tips of toes in conversion takes place through freely reduced voltage based on the stirrup. That clothe feet down while riding a desired spring ankle that more adequately strengthened controls body in sagittal plane in becoming free.

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