Research Article

Neuromotor Development of Children Aged 6 and 7 Years Born before the 30th Week Gestation

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Introduction. The aim of this study was to evaluate and compare the level of neuromotor function and somatic development in 6- and 7-year-old children born before the 30th week gestation with that in full-term children at the same age, as well as the correlation between prematurity and motor development. *Material and Methods.* The study group consisted of prematurely born 40 children. Their mean gestational age at birth was 27.8 ± 1.6 weeks (range 24-30 weeks). The control group consisted of 40 healthy children born with normal birth weight (>2500 g). The neuromotor function was assessed using Touwen neurological examination criteria. During the examination, the attention was focused on the hand preference, laterality, synkinesis, and asymmetry. In addition, children's weight, height, and BMI index were measured. *Results.* Premature children showed much worse results than full-term ones in hand function (p < 0,001). They obtained the best results in paper tearing while crossing the body midline turned out to be the most difficult. Considering the quality of walking, the biggest difficulty for the premature children was to walk backwards along the straight line while during normal walking they showed the best results. The results for the muscle tone subcategory in the study group were also significantly worse than those in control group (p < 0,001), as well as the total outcome for the movement coordination and diadochokinesis subcategories (p < 0,001). *Conclusion.* The nondisabled, prematurely born children have significantly lower average outcomes regarding hand function, quality of walking, muscle tone, coordination, and diadochokinesis at age of six to seven, compared to the full-term peers.

1. Introduction

The incidence of preterm delivery has been increasing and the survival rate of preterm children has risen steadily due to advances in obstetric and neonatal intensive care [1]. According to the World Health Organization (WHO), the infants born before 32nd week of pregnancy are considered very preterm (VPT) infants [2]. The WHO estimated that, in 2015, 15 million infants were born before 37 weeks of gestation. Across 184 countries, the rate of preterm birth ranges from 5% to 18%. Preterm infants are being allocated to two categories according to their birth weight: low birth weight (LBW) and very low birth weight (VLBW) when their birth weight ranges from <2500 grams and <1500 grams, respectively [3]. Recent studies show a diminishing prevalence of severe motor disabilities in preterm children, but mild neurodevelopmental impairments remain dominating problems for preschool and school-aged children [4]. Children born prematurely may present delays in the motor [5–8], adaptive [9], cognitive [5, 6, 8, 10], and language [5, 6, 8, 11] domains, even if the deficits in these areas are subtle [5]. These domains are interdependent; that is, each one influences and is influenced by the other.

Motor deficits in coordination, balance, gross and fine motor control, visual spatial, and visual motor integration have been reported in preterm children without CP, but can be more accurately evaluated at a later age [12, 13]. Among other characteristics, parents describe such children as "clumsy," with decreased hand-eye coordination and motor control challenges. These mild neurodevelopmental impairments tend to persist into later childhood, which might challenge children's successful participation in everyday life both at school and at home [14, 15].

Although long-term developmental changes in preterm children are well described in the literature, the occurrence of these difficulties at preschool age is less documented. Neither the degree of prematurity nor early cognitive testing predicts which children within nondisabled, preterm groups will have poorer functional performance and will require extra services [16]. Therefore, further investigation to obtain a more indepth understanding of the impairments and activity limitations among nondisabled extremely preterm or ELBW children at preschool age is required. The findings will provide useful information to assist in the development of strategies to provide better results for this population of children.

2. Purpose

The aim of this study was to evaluate and compare the level of neuromotor function and somatic development in 6- and 7year-old children born before the 30th week gestation with that in full-term children at the same age, as well as the correlations between prematurity and motor development.

3. Material and Methods

Ethical approval for the study was granted by the Ethics Committee of the University of Rzeszow. Written formal consent was obtained from the parents of all subjects who participated in this study.

3.1. Participants. Data for this study was collected between August 2007 and July 2009. The study group consisted of prematurely born 40 children (19 females, 21 males), whose personal data were acquired from the database of the Neonatology Department at the County Hospital No. 2 in Rzeszów, Poland. Their mean gestational age at birth was 27.8 \pm 1.6 weeks (range 24-30 weeks). Mean birth weight was 1124 g (range 570 g-1300 g). Mean chronological age was 6 years and 8 months (range from 5 years and 9 months to 7 years and 4 months). The authors excluded children with major congenital malformations, genetic chromosomal abnormalities, metabolic disorders, cerebral palsy (CP) that interfered with locomotion, congenital infections, sign of encephalopathy or seizures during their neonatal course, and retinopathy of prematurity greater than stage 2, because it had been assumed that these infants would have already developed poor neurodevelopmental disorders when compared with healthy children. Children with a visual impairment not corrected by wearing corrective lenses and those with a hearing impairment not corrected by hearing aids were also excluded. The early medical status of preterm infants was extracted from medical records. Then parents of eligible children were contacted to inquire whether they wished to receive further information and appropriate consent forms to complete.

The control group consisted of 40 healthy children (20 females, 20 males) born with normal birth weight (>2500 g),

the pupils of primary schools in Rzeszów who were born between February 2002 and January 2003. First, requests to the headmasters of these schools were submitted in order to obtain the school's permission for participation in the research. Next, the children received a letter to their parents, which explained the purpose of the study and requested their consent regarding the children participation in this study. Children with a history of admission to neonatal intensive care unit, gestation of <37 or >42 weeks, infants born from multiple pregnancies, and those with musculoskeletal, neurological, genetic, and other disorders that could negatively influence motor development were excluded from the control group. The proper developmental status of children in the control group had been confirmed by paediatricians based on previous medical periodic examinations. Data concerning children's birth and neonatal status were provided by their parents. Children whose parents signed the formal written consent confirming their participation in the study were evaluated.

3.2. Procedure. Standardized and age-specific assessment, according to Touwen neurological examination criteria for children with minor neurological dysfunction (MND), was used in this study [17]. The Touwen neurological examination is free of charge, well-known, and commonly used assessment method, which is specially designed for the evaluation of the following minor neurological dysfunction in children: mild abnormalities in muscle tone (clinical test by passive movement), diadochokinesis, quality of walking, posture, mild problems with coordination, and hand function.

Modified, performance based assessment criteria were applied for the evaluation of all the tests in our study, considering all subcategories (hand function, quality of walking, muscle tone, movement coordination, and diadochokinesis). Each test was scored using 4-point scale, from 0 to 3 (0 =lowest possible score up to 3 = best, optimal score). Then the numeric scores were categorized as a "lack of skills," weak, medium and "optimal," respectively. Additionally, total outcome in each subcategory was calculated, as a percentage of optimal score, in the following manner: each child score described as "lack of skills" was graded as 0% while that described as "optimal" was graded as 100%. Overall outcome, as a sum of the average scores in each subcategories, divided by the number of subcategories, was also calculated. During the examination, the attention was also focused on the hand preference, laterality, synkinesis, and asymmetry. In addition, children's weight (kilograms), height (centimeters), and the BMI index (kgm2) were measured.

All assessments were completed by the same experienced physiotherapist who was trained in testing protocol and who had no previous access to information regarding the birth status and medical history of the subjects. Each child was evaluated under the same environmental conditions and completed all the testing in one day. Each assessment took approximately one hour and took place in the County Hospital No. 2 in Rzeszów.

3.3. Statistical Analysis. All calculations and statistical analyses were performed using STATISTICA ver. 10.0 (StatSoft,

		S	tudy group				Сс	ontrol group)		6
	\overline{x}	Me	Min	Max	s	\overline{x}	Me	Min	Max	s	P
Body height	120,9	121,0	104	133	6,2	120,4	120,0	112	134	5,1	0,668
Body mass	22,8	24,0	14	30	4,0	22,9	22,0	18	32	3,7	0,843
BMI	15,5	16,0	11,8	19,0	2,0	15,7	15,6	12,3	22,2	1,9	0,527

 TABLE 1: Somatic development of children.

Max: maximum value; Me: median; Min: minimal value; p: test probability value; s: standard deviation; \overline{x} : mean.

TABLE 2: Hand preferences in study and control group.

Hand preference	Gr	oup	Total
(p = 0,003)	Study	Control	Iotai
Right handed	27 (68%)	35 (88%)	62
Left handed	3 (8%)	5 (13%)	8
Both handed	10 (25%)	0 (0%)	10
Total	40	40	80

p: test probability value.

Poland). Statistical significance level was assumed at $p \le 0.05$. The Shapiro-Wilk test was used for the evaluation of normal data distribution. Basic descriptive statistical analyses were conducted for all variables. Adequate parametric or nonparametric statistical tests, depending on the data type and distribution, were used for the comparison of the results between the groups. Independent *t*-test was used for normally distributed data. The Chi-Square test was used to determine statistically significant differences for categorical measures while Spearman's rank correlation coefficient was used to measure the strength and direction of correlation between two sets of data.

4. Results

There were no statistically significant differences between the level of somatic development of children in both groups (Table 1).

There are statistically significant differences regarding hand preferences between the groups; in the study group there were less right handed children and more both handed. Sixty-eight percent of the children in study group were right handed compared to 88% in the control group. Moreover, the fact that 25% of the subjects in the group of preterm children were both handed while in control group none of children presented both hand preferences seems to be very interesting (Table 2).

The differences of the results of all tests in hand function subcategory between the study and control group were statistically significant. Premature children showed worse results than those born full term. Considering hand function, premature children obtained the best results in paper tearing while crossing the body midline turned out to be the most difficult (Table 3).

In the quality of walking subcategory, the biggest difficulty for premature children was to walk backwards along straight line while assessment of normal walking provided the best results (Table 4).

The results of all tests in muscle tone subcategory were significantly worse in the study group, compared to the control group (Table 5).

In all tests evaluating movement coordination, the children from study group obtained significantly worse results than the children from control group (Table 6).

In diadochokinesis subcategory the biggest difficulty for premature children were observed in reaching for the ears with crossed arms test and finger-opposition test (Table 7).

Comparison of the total outcomes for each of the functional subcategories in our study revealed significant differences between preterm children and their full-term peers (p < 0,001). The difference in overall outcome (average level of the results considering all subcategories) was also statistically significant (p < 0,001) (Table 8).

The correlations between gestation time and the results of each test used in our study, as well as total outcome for the subcategory, were also analysed. The degree of prematurity had statistically significant influence only on the results of three tests in the hand function subcategory, while the strength of those correlations was moderate (Table 9).

5. Discussion

Both technological advances in neonatology over the last few decades and increased survival of preterm infants have made it important to consider the long-term outcomes concerning their developmental status. Children born prematurely may present developmental delays even in the absence of severe neurological disorders [6-8, 18-20]. Many researchers are interested in investigating the preterm children population without major neurological impairments because milder functional problems are often not being diagnosed until these children reach their school age [21]. These subtle movement dysfunctions do not occur due to known physical disorders, such as cerebral palsy, hemiplegia, or muscular dystrophy. It is estimated that 40-70% of children born prematurely are showing minor disabilities such as mild motor problems and poor adaptive behaviors during preschool and school years [9]. School children born with extreme prematurity, without any significant neurological problem or developmental impairment presented worse performance in sensorimotor and visuospatial competencies, as well as in attention and executive function when compared with children born at term [10]. Therefore, it is very important to identify potential neurodevelopmental impairments at younger age in order to

			ТАВLЕ 3: На	und function.					
Hand function	Optimal	Study Medium	Group Weak	Lack of skills	Optimal	Contro Medium	ol Group Weak	Lack of skills	d
Copying a picture	1				1				
N	13	16	7	4	34	9	0	0	100.01
%	33%	40%	18%	10%	85%	15%	%0	%0	<0,001
Drawing a picture of a doll									
	10	12	16	2	33	7	0	0	100.07
%	25%	30%	40%	5%	83%	18%	%0	%0	<0,001
Tying shoelaces									
N	17	8	7	8	31	1	33	33	
%	43%	20%	18%	20%	82%	3%	8%	8%	0,004
Writing their name									
N	15	10	8	9	33	7	0	0	100.07
%	38%	26%	21%	15%	83%	18%	%0	%0	<0,001
Cutting a piece of paper with a pair of scissors									
N \sim	16	19	б	2	38	1	0	0	100.02
%	40%	48%	8%	5%	97%	3%	%0	%0	IUUU(U)
Tearing a piece of paper									
Ν	25	12	1	2	39	1	0	0	100.07
%	63%	30%	3%	5%	98%	3%	%0	%0	IUUU(U)
Putting matches in a box									
N	6	22	7	2	39	1	0	0	100.07
%	23%	55%	18%	5%	98%	3%	%0	%0	<0,001
Crossing the body midline									
Ν	9	8	23	33	38	2	0	0	100.07
%	15%	20%	57%	8%	95%	5%	%0	0%0	100,02
%: percent of tested subjects; N: number of tested subj	jects; p: test probab	ility value.							

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			TABLE 4:	Quality of walking.					
Quality of walking		Study	y group			Contr	ol group		đ
0	Optimal	Medium	Weak	Lack of skills	Optimal	Medium	Weak	Lack of skills	T
Quality of normal walking									
Ν	20	14	4	2	40	0	0	0	100.07
%	50%	35%	10%	5%	100%	0%0	%0	%0	<0,001
Walking on tiptoes									
N	1	20	16	3	36	4	0	0	100.07
%	3%	50%	40%	8%	80%	10%	%0	0%0	<0,001
Walking on heels									
N _	12	17	9	J.	40	0	0	0	100.07
%	30%	43%	15%	13%	100%	0%	%0	%0	<0,001
Walking along a straight line									
Ν	6	21	IJ	4	40	0	0	0	100.07
%	23%	54%	13%	10%	100%	0%0	%0	%0	<0,001
Walking backward along a straight line									
N	0	9	27	9	33	7	0	0	100.07
%	%0	15%	69%	15%	83%	18%	%0	%0	
Quality of running									
N	8	20	7	4	39	0	0	0	100.07
%	21%	51%	18%	10%	100%	%0	%0	%0	
%: percent of tested subjects; N : number of teste	ed subjects; p: test p	robability value.							

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	,	Study	y group		,	Contro	ol Group		¢
	Optimal	Medium	Weak	Lack of skills	Optimal	Medium	Weak	Lack of skills	ч
of the right and left shoulders									
	ŝ	28	5	2	39	1	0	0	
	13%	20%	13%	5%	98%	3%	0%	0%	100,0>
of the right and left hips with extended knees									
	б	24	10	3	37	3	0	0	
	8%	60%	25%	8%	93%	8%	%0	0%0	<0,001
of the right and left ankles (dorsal flexion)									
9	9	19	12	33	35	IJ	0	0	
	15%	48%	30%	8%	88%	13%	%0	0%0	
the toes with the fingers while standing with extended knees									
•	9	15	10	6	33	7	0	0	
	15%	38%	25%	23%	83%	18%	%0	0%0	IUUU,U>
e the trunk while sitting									
	14	20	3	3	39	0	0	0	
	35%	50%	8%	8%	100%	%0	%0	0%0	<0,001
t down with the heels on the floor									
	Ŋ	18	12	IJ	35	IJ	0	0	
	13%	45%	30%	13%	88%	13%	%0	0%	ruu,u>

	TA	BLE 6: Moverr	nent coordi	nation.					
Movement coordination	Optimal	Study Medium	/ group Weak	Lack of skills	Optimal	Contro Medium	l group Weak	Lack of skills	b
Catching a ball					-				
N	28	10	0	2	40	0	0	0	
%	70%	25%	0%	5%	100%	%0	0%	%0	
Skipping gait (light hops on each foot)									
Ν	9	25	9	3	40	0	0	0	
%	15%	63%	15%	8%	100%	%0	0%	%0	100,0>
Leaping like a frog									
Ν	6	19	7	4	37	3	0	0	100.07
%	23%	49%	18%	10%	93%	8%	0%	%0	100,0>
Slow and fast pronation/supination with arms extended in front									
N	6	19	10	2	40	0	0	0	100.07
%	23%	48%	25%	5%	100%	0%0	%0	0%0	<0,001
Flexion and extension of wrists									
N	13	14	6	4	40	0	0	0	100.02
%	33%	35%	23%	10%	100%	%0	0%	%0	100,0>
Sitting up from supine without the help of the arms									
Ν	б	13	18	9	32	7	0	0	100.07
%	8%	33%	45%	15%	82%	18%	0%	%0	
Hopping on the right or left leg									
Ν	Ŋ	24	7	3	39	0	0	0	100.07
%	13%	62%	18%	8%	100%	%0	0%	%0	100,0>
Standing on right and left leg (eyes open)									
Ν	10	18	8	3	39	0	0	0	100.07
%	26%	46%	21%	8%	100%	%0	0%	%0	100°0>
Standing on right and left leg (eyes closed)									
	1	6	24	9	35	4	0	0	
%	3%	23%	60%	15%	%06	10%	0%	%0	100,0>
Knee-heel test in supine with the eyes open and closed									
Ν	б	18	14	4	36	2	0	0	100.07
%	8%	46%	36%	10%	95%	5%	%0	%0	τννίν>

%: percent of tested subjects; N: number of tested subjects; p: test probability value.

Diadochokinesis with closed eyes	-	Study	group	1.1.7	-	Contro	ol group		d
	Optimal	Medium	Weak	Lack of skills	Optimal	Medium	Weak	Lack of skills	7
Right-left arm pronation and supination with fast alternating movements									
N	IJ	22	10	2	39	1	0	0	100.02
%	13%	56%	26%	5%	98%	3%	0%	%0	TUU,U
Finger-nose test									
N	14	21	2	3	39	1	0	0	100.02
%	35%	53%	5%	8%	98%	3%	0%	%0	TUU,U>
Reaching for the ears with crossed arms									
N	1	12	23	3	35	Ŋ	0	0	100.02
%	3%	31%	59%	8%	88%	13%	0%	%0	
Finger-finger test									
Ν	13	18	9	3	40	0	0	0	100.02
%	33%	45%	15%	8%	100%	0%	%0	%0	
Finger-opposition test									
N	2	10	25	3	38	2	0	0	100.02
%	5%	25%	63%	8%	95%	5%	%0	%0	TUU,U
%: percent of tested subjects; N : number of tested subjects; p : test probability value.									

closed eyes.
with
Diadochokinesis
i
TABLE

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			- 0			·	-	-			
Cubatacour			Study group					Control group			¢
Subcategol y	$ \chi $	Me	Min	Max	s	8	Me	Min	Max	s	μ
Hand function	65%	%69	%0	100%	24%	96%	100%	75%	100%	7%	<0,001
Quality of walking	58%	61%	%0	94%	23%	98%	100%	89%	100%	3%	<0,001
Passive muscle tone	58%	61%	%0	94%	18%	97%	100%	83%	100%	5%	<0,001
Movement coordination	59%	62%	%0	%06	21%	%66	100%	%06	100%	3%	<0,001
Diadochokinesis	57%	60%	%0	92%	19%	%66	100%	87%	100%	3%	<0,001
Overall outcome	60%	63%	%0	%06	19%	98%	%66	88%	100%	3%	<0,001
Max: maximum value; Me: medić	an; M*in: minim	ial value; p: test]	probability value;	s: standard devia	ation; \overline{x} : mean.						

TABLE 8: Subcategory total outcome and overall outcome results: study group versus control group.

Hand functiongetation timeImage a picture0.460.003Drawing a picture of a dall0.380.044Uring abolicas0.240.043Withing picture of a dall0.370.021Catting a picture of paper0.160.333Parting a picce of paper with a pair of scissors-0.020.205Tarring a picce of paper0.160.333Patting makhes in a box0.090.573Torsing the brok pinvillence0.330.036Quality of normal walking-0.010.953Walking on tiptoes0.070.665Walking on backs0.040.620Walking and pictoes0.010.953Walking and pictoes0.010.959Total outcome-0.010.959Total outcome-0.010.959Total outcome0.250.0166Manipulation of the right and left aboulders0.250.166Manipulation of the right and left aboulders0.220.166Manipulation of the right and left aboulders0.010.959Total outcome0.030.856Total outcome0.030.856Total outcome0.030.957Schlipty to rotat the trunk while standing0.010.953Walking on and left aboulders0.010.953Maring and fit pictor while standing0.010.953Maring and fit pictor while standing0.010.953Maring and fit pictor while standing0.010.953	· · · · · · · · · · · · · · · · · · ·	Correlat	ion with
RPOxpring a picture of a doll0.380.004Drawing a picture of a doll0.380.004Tying shocaces0.240.143Writing their name0.370.021Cutting a piece of paper with a pair of scissors-0.020.890Tearing a piece of paper0.160.333Putting matches in a box0.090.573Crossing the body midline0.200.205Total outcome0.330.036Putting matches0.070.665Walking on thels0.040.8200Walking on thels0.010.953Walking on thels0.010.959Total outcome-0.010.959Total outcome0.020.05Walking on thels0.010.959Walking on theight and left shoulders0.250.116Manipulation of the right and left shoulders0.250.116Manipulation of the right and left shoulders0.020.957Ability to scalt the tox while firgers while standing with extended knees0.220.166Manipulation of the right and left shoulders0.020.957Total outcome0.030.8560.26Total outcome0.030.8560.26Total outcome0.030.8560.26Total outcome0.040.7930.64Manipulation of the right and left shoulders0.010.973Ability to scalt the truth while sitting0.010.963Ability to scalt the trut	Hand function	gestatio	on time
Copying a picture0,460,008Draving a picture of a doll0,380,014Tying shoelaces0,240,143Writing their name0,370,021Cutting a pice of paper with p air of scissors0,090,573Torsing the body milline0,200,205Total out		R	P
Drawing a picture of a doll0,380,044Tying abocaces0,240,443Withing their name0,370,021Cutting a piece of paper0,160,333Putting matches in a box0,090,573Crossing the body midline0,200,205Total outcome0,330,036Walking on inplotes0,010,953Walking on hels0,040,833Walking on hels0,040,833Walking on hels0,040,833Walking on hels0,040,833Walking on hels0,040,833Walking bolcward along a straight line0,030,870Quality of running0,010,953Total outcome0,010,953Manipulation of the right and left shoulders0,220,166Kanes0,220,166Kanes0,220,166Kanes0,230,870Ability to reach the tors with the fingers while standing0,240,963Ability to reach the tors with the fingers while standing0,2670,267Total outcome0,330,8560,36Ability to reach the tors with the fingers while standing0,010,973Ability to reach the tors with the fingers while standing0,010,973Ability to reach the tors with the fingers while standing0,010,973Ability to reach the tors with the fingers while standing0,010,973Ability to reach the tors with the fingers while standing0,01	Copying a picture	0,46	0,003
Tying sheakees0.240.413Writing their name0.370.621Catting a piece of paper with a pair of scissors-0.020.890Tearing a piece of paper0.160.33Druting matches in a box0.090.205Total outcome0.200.205Total outcome0.330.05Quality of normal walking-0.010.953Walking on tipbes0.070.665Walking on tipbes0.070.685Walking a backward along a straight line0.030.870Walking backward along a straight line0.030.879Total outcome-0.010.953Maipulation of the right and left shoulders0.220.166Manipulation of the right and left shoulders0.220.166Manipulation of the right and left shoulders0.010.953Ability to reach the toos with the fingers while standing with extended knees0.220.166Manipulation of the right and left shoulders0.010.963Ability to rotate the trunk while sitting0.000.987Ability to rotate the trunk while sitting0.010.963Ability to rotate the trunk while sitting0.02 <td>Drawing a picture of a doll</td> <td>0,38</td> <td>0,014</td>	Drawing a picture of a doll	0,38	0,014
Writing a piec of paper with a pair of scissors0,370,021Cutting a piece of paper0,160,333Putting matches in a box0,090,733Torsing the body milline0,200,205Total outcome0,300,036Quality of normal walking0,010,933Walking on tels0,070,665Walking on hels0,040,820Walking on hels0,040,820Walking backward along a straight line0,030,879Quality of running0,010,933Total outcome-0,010,933Walking hore straight line0,020,01Manipulation of the right and left shoulders0,020,16Manipulation of the right and left shoulders0,220,16Manipulation of the right and left matches (dorsificxion)0,140,375Ability to reach the tors with the fingers while standing with extended knees0,000,987Ability to rotate the trunk while sitting0,000,987Ability to rotate the trunk while standing with extended knees0,010,903Ability to rotate the fingers while standing with extended knees0,010,963Ability to rotate the trunk while sitting0,010,963Ability to rotate the trunk while sitting0,010,976Ability to rotate the trunk while sitting0,010,976Ability to rotate the trunk while sitting0,010,976Ability to rotate the trunk while sitting0,010,976Abil	Tying shoelaces	0,24	0,143
Catting a piece of paper with a pair of scissors-0.020.890Tearing a piece of paper0.1610.333Patting matches in a box0.090.573Crossing the body midline0.200.205Total outcome0.330.036Quality of normal valking-0.010.953Walking on triptoes0.040.663Walking no treeds0.040.820Walking no heels0.040.820Walking along a straight line-0.040.813Walking along a straight line0.010.959Total outcome0.010.959Total outcome0.220.166Manipulation of the right and left shoulders0.220.166Manipulation of the right and left shoulders0.220.166Manipulation of the right and left shoulders0.010.939Total outcome0.020.963Ability to rotate the trunk while isting0.000.987Ability to rotate the truek while isting0.010.963Total outcome0.330.267Total outcome0.330.267Total outcome0.330.267Stipping gait (light hops on each foot)0.340.23Stipping gait (light hops on each foot)0.340.94Stipping gait (light hops on each foot)0.230.955Total outcome0.030.954Stipping gait fuight hops on each foot)0.230.957Stipping gait fuight hop on each foot)0.260.275St	Writing their name	0,37	0,021
Taring apiece of paper0.160.333Putting matches in a box0.090.573Crossing the body mildine0.200.205Total outcome0.330.036Quality of normal walking0.010.953Walking on tipbes0.070.6655Walking on a straight line0.040.820Walking on a straight line0.030.870Quality of running0.010.953Total outcome-0.010.953Walking bods a straight line0.030.870Quality of running0.010.959Total outcome-0.010.953Manipulation of the right and left shoulders0.250.116Manipulation of the right and left shoulders0.220.166Manipulation of the right and left shoulders0.000.963Ability to reach the tores with the fingers while standing with extended knees0.000.963Ability to reach the tores with the fingers while standing with extended knees0.040.979Ability to rotation of wrists-0.010.963Ability to rotation of wrists-0.070.648Straig a forg0.110.4020.973Easi of far of and first port of the arms-0.010.973Skipfing gait (light hops on each foot)0.230.355Total outcome0.040.7990.36Skipfing a forg0.110.4020.973Skipfing a forg0.110.4040.798Skipfing a forg0.230.35	Cutting a piece of paper with a pair of scissors	-0,02	0,890
Putting matches in a box0.090.573Crossing the body midline0.200.205Total outcome0.330.036Quality of normal walking-0.010.953Walking on hords0.070.665Walking on hords0.0440.820Walking on hords0.030.870Walking backward along a straight line0.030.870Quality of running0.010.959Total outcome-0.010.953Manipulation of the right and left shoulders0.250.166Manipulation of the right and left hips with extended knees0.220.166Manipulation of the right and left ankles (dorsiflexion)0.140.375Ability to rotatc the trunk while standing with extended knees-0.010.963Ability to rotat the trunk while standing with extended knees0.030.887Ability to rotat the trunk while standing with extended knees0.040.799Skipping gait (light hops on each foot)0.340.402Leaping like a frog Slow and fast pronation/supination with arms extended Slow and fast pronation/supination with arms extended Slow and fast pronation supine without the help of the arms-0.010.963Skapping on tright and left lige (yees closed)0.040.7990.783Skapping on the right and left lige (yees closed)0.040.7910.648Slitting up from supine without the help of the arms-0.010.9630.763Shading on right and left lige (yees open)0.260.0140.793<	Tearing a piece of paper	0,16	0,333
Crossing the body midline0.200.205Total outcome0.330.036Quality of normal walking-0.010.953Walking on tiptoes0.070.665Walking on beds0.040.820Walking backward along a straight line-0.040.813Walking backward along a straight line0.030.959Total outcome-0.010.959Total outcome-0.010.959Total outcome0.020.166Manipulation of the right and left shoulders0.220.166Manipulation of the right and left shoulders0.020.963Ability to reach the toes with the fingers while standing with extended knees0.000.987Ability to rotate the trunk while sitting0.000.987Ability to rotate the trunk while standing with extended knees0.010.963Ability to rotate the trunk while sitting0.040.799Skipping gait (ligh tops on each foot)0.140.479Skipping gait (ligh tops on each foot)0.010.973Flexion and fast pronation/supination with arms extended in front0.010.973Flexion and fast pronation full the legic solen0.020.174Straing on right and left leg (eyes copen)0.260.110Straing on right and left leg (eyes copen)0.260.101Straing on right and left leg (eyes copen)0.260.174Straing on right and left leg (eyes copen)0.260.174Straing on right and left leg (eyes copen)0.26 <td>Putting matches in a box</td> <td>0,09</td> <td>0,573</td>	Putting matches in a box	0,09	0,573
Total outcome0,330,036Quality of normal walking-0.010.953Walking on niptoes0,070.665Walking on teiptoes0,070.665Walking on straight line-0.040,813Walking along a straight line0.030.870Quality of running0,010.953Total outcome-0,010.953Total outcome-0,010.953Manipulation of the right and left shoulders0.250,116Manipulation of the right and left shoulders0.220,166Manipulation of the right and left shoulders0.000.953Ability to rotate the trunk while sitting0,000.953Ability to rotate the trunk while sitting0,000.955Total outcome0,180.267Morement coordination0,140.402Catching a ball0,040.799Skipping gait (light hops on each foot)0,140,402Leaping like a frog0,110,945Slow and fast pronation/supination with arms extended0,010,973Flexion and extension of wrists-0,070,648Sitting on right and left leg (yes open)0,260,110Shanding on right and left leg (yes open)0,040,793Strading on right and left leg (yes open)0,040,793Skipping gait (light hops on each foot)0,260,101Shanding on right and left leg (yes open)0,040,793Skipping gait (light hops on each foot)0,260,101	Crossing the body midline	0,20	0,205
Quality of normal walking -0,01 0,953 Walking on triptoes 0,07 0,665 Walking on teels 0,04 0,820 Walking backward along a straight line 0,03 0,870 Quality of running 0,01 0,959 Total outcome 0,01 0,959 Total outcome 0,02 0,16 Manipulation of the right and left shoulders 0,22 0,16 Manipulation of the right and left shoulders 0,22 0,16 Manipulation of the right and left shoulders 0,01 0,953 Manipulation of the right and left shoulders 0,02 0,16 Manipulation of the right and left ankles (dorsiflexion) 0,14 0,375 Ability to reach the bes with the fingers while standing -0,01 0,963 With extended knees 0,03 0,885 Ability to rotate the trunk while sitting 0,00 0,973 Stripting gait (fight hops on each foot) 0,14 0,402 Laping like a frog 0,01 0,973 Flexion and textension of wrists -0,07 0,648	Total outcome	0,33	0,036
Quality of normal walking-0,010,953Walking on tiptoes0,040,820Walking on heels0,040,820Walking along a straight line-0,040,813Walking backward along a straight line0,030,870Quality of running0,010,959Total outcome-0,010,953Interpret of the right and left shoulders0,220,166Manipulation of the right and left shoulders0,220,166Kanajpulation of the right and left ankles (dorsiflexion)0,140,375Ability to reach the toes with the fingers while standing with extended knees-0,010,963Ability to reach the toes with the fingers while standing with extended knees0,000,987Ability to reach the toes with the hele on the floor0,030,856Total outcome0,140,4020,299Skipping gait (light hops on each foot)0,140,4020,2973Flexion and extension of wrists-0,010,9440,402Leaping like a frog0,010,9730,555Standing on right and left leg (eyes closed)0,040,799Vitting up from supine without the help of the arms-0,010,944Hopping on the right and left leg (eyes closed)0,040,783Standing on right and left leg (eyes closed)0,040,783Standing on right and left leg (eyes closed)0,040,783Total outcome0,040,7830,787Total outcome0,040,7830,745<	Quality of walking	ng	
Walking on tiptoes0,070,665Walking along a straight line-0,040,833Walking along a straight line0,030,870Quality of running0,010,959Total outcome0,010,959Muscle toneMuscle toneManipulation of the right and left shoulders0,220,166Manipulation of the right and left ankles (dorsiflexion)0,140,375Ability to reach the toss with the fingers while standing with extended knees-0,010,963Ability to rotate the trunk while sitting0,000,987Ability to rotate the trunk while sitting0,000,987Ability to squat down with the heels on the floor0,180,267Total outcome0,010,963Skipping gait (light hops on each foot)0,140,402Leaping like a forg0,110,496Slow and fast pronation/supination with arms extended Slow and fast pronation/supination with arms extended-0,070,648Sitting up from supine without the help of the arms-0,070,648Sitting on right and left leg (eyes open)0,240,733Kanding on right and left leg (eyes colsed)0,040,733Kanding on right and left leg (eyes colsed)0,040,735Standing on right and left leg (eyes colsed)0,040,734Catching a ball0,040,7340,745Standing on right and left leg (eyes colsed)0,040,735Standing on right and left leg (ey	Quality of normal walking	-0,01	0,953
Walking on heels0.040.820Walking backward along a straight line0.030.870Quality of running0.010.959Total outcome0.010.959Total outcome0.0250.116Manipulation of the right and left shoulders0.220.166Manipulation of the right and left hips with extended knees0.220.166Manipulation of the right and left nakles (dorsiflexion)0.140.375Ability to reach the tors with the fingers while standing with extended knees-0.010.963Ability to rotate the trunk while sitting0.000.987Ability to squat down with the heels on the floor0.030.267Total outcome0.040.799Skipping gait (light hops on each foot)0.140.402Leaping like a frog0.010.973Flexton and extension of wrists-0.070.648Stitting up from supine without the help of the arms-0.010.973Flexton and extension of wrists-0.070.648Stitting up from supine with out the help of the arms-0.010.783Kingh and left leg (eyes open)0.260.110Opping on the right and left leg (eyes closed)0.040.783Flexton and extension of wrists0.030.870Reaching for the ears with closed arms-0.070.648Stitting up from supine without the help of the arms-0.010.781Flexton and extension and supination with fast0.080.627Total outcome0.04 <td>Walking on tiptoes</td> <td>0,07</td> <td>0,665</td>	Walking on tiptoes	0,07	0,665
Walking along a straight line-0.040.813Walking backward along a straight line0.030.870Quality of running0.010.953Total outcome-0.010.953Total outcome0.250.116Manipulation of the right and left hous with extended knees0.220.166Manipulation of the right and left ankles (dorsiflexion)0.140.375Ability to reach the toes with the fingers while standing with extended knees-0.010.963Ability to reach the toes with the fingers while standing0.000.987Ability to reach the toes with the fingers while standing0.000.9863Ability to reach the toes with the fingers while standing0.030.856Total outcome0.180.2670.18Verstraid work with the heels on the floor0.030.856Total outcome0.140.4020.979Skipping gait (light hops on each foot)0.140.402Lapping like a frog0.110.496Sliving agait (light hops on each foot)0.010.973Flexion and extension of wrists-0.070.648Sitting up from supine without the help of the arms-0.010.944Hopping on the right and left leg (eyes open)0.040.783Knee-heel test in supine with the types open and closed-0.050.745Total outcome0.030.6270.745Standing on right and left leg (eyes closed)0.030.876Cotal outcome0.030.6270.745 </td <td>Walking on heels</td> <td>0,04</td> <td>0,820</td>	Walking on heels	0,04	0,820
Walking backward along a straight line0.030.870Quality of running0.010.9593Total outcome-0.010.9533Muscle tone0.250.116Manipulation of the right and left shoulders0.220.166Manipulation of the right and left hips with extended knees0.220.166Manipulation of the right and left ankles (dorsiflexion)0.140.375Ability to reach the toes with the fingers while standing with extended knees-0.010.963Ability to rotate the trunk while sitting0.000.987Ability to rotate the trunk while sitting0.000.987Ability to squat down with the heels on the floor0.030.856Total outcome0.040.799Skipping gait (light hops on each foot)0.140.402Leaping like a frog0.010.973Slow and fast pronation/supination with arms extended hopping on the right or left leg (eyes open)0.0260.110Standing on right and left leg (eyes open)0.260.1000.944Hopping on right and left leg (eyes open)0.040.7930.745Total outcome0.030.8700.7450.745Total outcome0.030.8630.6270.110Standing on right and left leg (eyes open and closed erg0.030.870Flexing novements0.030.8700.873Flexing novements0.030.8700.873Fliger-nose test0.030.8700.313Finger-nose test	Walking along a straight line	-0,04	0,813
Quality of running0.010.959Total outcome-0.010.953Muscle toneManipulation of the right and left shoulders0.250.116Manipulation of the right and left hips with extended knees0.220.166Manipulation of the right and left ankles (dorsiflexion)0.140.375Ability to reach the toes with the fingers while standing with extended knees-0.010.963Ability to reach the toes with the fingers while standing with extended knees0.000.987Ability to reach the toes with the fingers while standing with extended knees0.000.987Catching a bull0.000.9870.180.267Movement coordination0.180.267Catching a ball0.040.799Skipping gait (light hops on each foot)0.140.402Leaping like a frog0.110.496Slow and fast pronation/supination with arms extended in front0.010.973Flexion and extension of wrists-0.070.648Sitting up from supine without the help of the arms-0.010.944Hopping on right and left leg (eyes open)0.260.110Standing on right and left leg (eyes open and closed tore)0.040.783Knee-heel test in supine with the eyes open and closed eyes0.030.870Finger-noset test0.030.8700.745Total outcome0.030.8700.745Total outcome0.030.8700.725Finger-noset test0	Walking backward along a straight line	0,03	0,870
Total outcome-0.010.953Muscle toneManipulation of the right and left shoulders0.250.116Manipulation of the right and left hips with extended knees0.220.166Manipulation of the right and left ankles (dorsiflexion)0.140.375Ability to reach the toes with the fingers while standing with extended knees-0.010.963Ability to reach the toes with the fingers while standing with extended knees-0.010.963Ability to reach the toes with the fingers while standing with extended knees0.000.987Ability to rotate the trunk while sitting0.000.987Ability to squat down with the hels on the floor0.030.856Total outcome0.180.267Movement coordination0.140.402Leaping like a frog0.110.496Slow and fast pronation/supination with arms extended in front0.010.973Flexion and extension of wrists-0.070.648Slitting up from supine without the help of the arms-0.070.648Hopping on the right and left leg (eyes open)0.260.110Standing on right and left leg (eyes closed)0.040.790Diadochokinesis with closed eyes-0.070.475Finger-nose test0.030.870Right-left arm pronation and supination with fast alternating movements0.030.870Finger-nose test0.030.870Reaching for the ears with crossed arms-0.170.313Finger-nose tes	Quality of running	0,01	0,959
Muscle tone Musipulation of the right and left hips with extended 0,25 0,116 Manipulation of the right and left hips with extended 0,22 0,166 Manipulation of the right and left ankles (dorsiflexion) 0,14 0,375 Ability to reach the toes with the fingers while standing with extended knees -0,01 0,963 Ability to reach the toes with the fingers while standing with extended knees 0,00 0,987 Ability to rotate the trunk while sitting 0,00 0,885 Total outcome 0,18 0,267 Stating a ball 0,04 0,799 Skipping gait (light hops on each foot) 0,14 0,402 Leaping like a frog 0,01 0,496 Slow and fast pronation/supination with arms extended 0,01 0,496 Slitting up from supine without the help of the arms -0,07 0,648 Slitting up from supine without the help of the arms -0,01 0,973 Standing on right and left leg (eyes closed) 0,04 0,783 Knee-hele test in supine with due eyes open and closed 0,04 0,783 Knee-hele test in supine with the sup of the arms 0,04 0,745 Standing on right and l	Total outcome	-0,01	0,953
Manipulation of the right and left shoulders0.250.116Manipulation of the right and left hips with extended knees0.220.166Manipulation of the right and left ankles (dorsiflexion)0.140.375Ability to reach the toes with the fingers while standing with extended knees-0,010.963Ability to reach the tores with the fingers while standing with extended knees0.000.887Ability to reach the tores with the fingers while standing with extended knees0.000.887Ability to rotate the trunk while sitting0.000.887Total outcome0.180.267Total outcome0.180.267Storing a ball0.040.799Skipping gait (light hops on each foot)0.140.402Leaping like a frog0.110.496Slow and fast pronation/supination with arms extended in front0.010.973Flexion and extension of wrists-0.070.648Sitting up from supine without the help of the arms-0.010.944Hopping on the right and left leg (eyes open)0.260.110Standing on right and left leg (eyes open)0.260.745Total outcome0.040.783Flexion and presents0.030.875Total outcome0.040.783Standing on right and left leg (eyes olesed)0.040.783Standing on right and left leg (eyes olesed)0.040.783Flexion and supination with fast alternating movements0.030.877 <trr>Flinger-nose test</trr>	Muscle tone		
Manipulation of the right and left hips with extended knees0.220.166Manipulation of the right and left ankles (dorsiflexion)0.140.375Ability to reach the toes with the fingers while standing with extended knees-0.010.963Ability to reach the trunk while sitting0.000.987Ability to totate the trunk while sitting0.000.987Ability to squat down with the heels on the floor0.030.856Total outcome0.180.227Catching a ball0.040.799Skipping gait (light hops on each foot)0.140.402Leaping like a frog0.110.446Slow and fast pronation/supination with arms extended in front0.010.973Flexion and extension of wrists-0.0070.648Sitting up from supine without the help of the arms-0.010.944Hopping on the right and left leg (eyes open)0.260.110Standing on right and left leg (eyes open)0.260.745Total outcome0.040.7800.745Total outcome0.030.8700.745Total outcome0.030.8700.647Right-left arm pronation and supination with fast alternating movements0.030.870Finger-nose test0.030.8700.871Finger-nose test0.030.8700.872Finger-nose test0.240.280.75Finger-opoposition test0.240.280.75Total outcome0.940.8800.75 <td>Manipulation of the right and left shoulders</td> <td>0,25</td> <td>0,116</td>	Manipulation of the right and left shoulders	0,25	0,116
Manipulation of the right and left ankles (dorsiflexion)0,140,375Ability to reach the toes with the fingers while standing with extended knees-0,010,963Ability to rotate the trunk while sitting0,000,987Ability to rotate the trunk while sitting0,030,856Total outcome0,180,267Movement coordinationCatching a ball0,040,799Skipping gait (light hops on each foot)0,110,496Catching a ball0,010,973Slow and fast pronation/supination with arms extended in front0,010,973Slow and fast pronation/supination with arms extended in front0,010,944Hopping on the right or left leg0,230,155Standing on right and left leg (eyes open)0,260,110Diadochokinesis with closed eyesNither ears0,030,870Right-left arm pronation and supination with fast alternating movements0,030,870Diadochokinesis with closed eyes0,030,870Right-left arm pronation and supination with fast alternating movements0,040,790Diadochokinesis with closed eyesRight-left arm pronation and supination with fast alternating movements0,040,871Finger-nose test0,030,870Right-left arm pronation and supination with fast alternating movements0	Manipulation of the right and left hips with extended knees	0,22	0,166
Ability to reach the toes with the fingers while standing with extended knees-0,010,963Ability to rotate the trunk while sitting0,000,987Ability to squat down with the heels on the floor0,030,856Total outcome0,180,267Movement coordinationCatching a ball0,040,799Skipping gait (light hops on each foot)0,140,402Leaping like a frog0,010,973Slow and fast pronation/supination with arms extended in front0,010,973Flexion and extension of wrists-0,070,648Sitting up from supine without the help of the arms-0,010,944Hopping on the right or left leg0,230,155Standing on right and left leg (eyes open)0,260,110Standing on right and left leg (eyes closed)0,040,783Total outcome-0,050,7450,745Total outcome-0,050,7450,745Total outcome-0,060,040,837Finger-nose test0,030,8700,870Reaching for the ears with crossed arms-0,170,313Finger-nopsetion test0,240,1280,075Finger-opposition test0,240,0750,075Total outcome0,240,240,075	Manipulation of the right and left ankles (dorsiflexion)	0,14	0,375
Ability to rotate the trunk while sitting0.000.987Ability to squat down with the hels on the floor0.030.856Total outcome0.180.267Movement coordinationCatching a ball0.040.799Skipping gait (ligh hops on each foot)0.140.402Leaping like a frog0.110.496Slow and fast pronation/supination with arms extended in front0.010.973Flexion and extension of wrists-0.070.648Sitting up from supine without the help of the arms-0.010.944Hopping on the right or left leg0.230.115Standing on right and left leg (eyes open)0.260.110Standing on right and left leg (eyes open)0.040.783Knee-heel test in supine with the eyes open and closed0.040.783Total outcome0.040.6270.627Fight-left arm pronation and supination with fast alternating movements0.030.627Finger-nose test0.030.6270.627Finger-nose test0.030.6270.627Finger-nose test0.280.040.783Finger-finger test0.240.240.23Finger-finger test0.240.260.04Station of the arms0.040.627Total outcome0.040.627Total outcome0.030.627Finger-nose test0.030.627Finger-finger test0.280.075Ford o	Ability to reach the toes with the fingers while standing with extended knees	-0,01	0,963
Ability to squat down with the heels on the floor0,030,856Total outcome0,180,267Movement coordinationCatching a ball0,040,799Skipping gait (light hops on each foot)0,140,402Leaping like a frog0,110,496Slow and fast pronation/supination with arms extended0,010,973Flexion and extension of wrists-0,070,648Stitting up from supine without the help of the arms-0,010,944Hopping on the right or left leg0,230,155Standing on right and left leg (eyes open)0,260,110Standing on right and left leg (eyes closed)0,040,783Knee-heel test in supine with the eyes open and closed-0,050,745Total outcome0,030,627Finger-nose test0,030,870Reaching for the cars with crossed arms-0,170,313Finger-finger test0,240,128Finger-opposition test0,240,128Finger-opposition test0,040,880	Ability to rotate the trunk while sitting	0,00	0,987
Total outcome 0,18 0,267 Movement coordination 0,04 0,799 Catching a ball 0,04 0,799 Skipping gait (light hops on each foot) 0,14 0,402 Leaping like a frog 0,11 0,496 Slow and fast pronation/supination with arms extended in front 0,01 0,973 Flexion and extension of wrists -0,07 0,648 Sitting up from supine without the help of the arms -0,01 0,944 Hopping on the right or left leg 0,225 0,110 Standing on right and left leg (eyes open) 0,266 0,110 Standing on right and left leg (eyes closed) 0,04 0,783 Knee-heel test in supine with the eyes open and closed -0,05 0,745 Total outcome 0,04 0,790 0,627 Finger-nose test 0,03 0,870 Reaching for the ears with crossed arms -0,17 0,313 Finger-finger test 0,24 0,128 Finger-opposition test 0,24 0,128	Ability to squat down with the heels on the floor	0,03	0,856
Movement coordinationCatching a ball0,040,799Skipping gait (light hops on each foot)0,140,402Leaping like a frog0,110,496Slow and fast pronation/supination with arms extended in front0,010,973Flexion and extension of wrists-0,070,648Sitting up from supine without the help of the arms-0,010,944Hopping on the right or left leg0,230,155Standing on right and left leg (eyes open)0,260,110Standing on right and left leg (eyes closed)0,040,783Knee-heel test in supine with the eyes open and closed-0,050,745Total outcome0,040,790Diadochokinesis with closed eyes0,080,627Finger-nose test0,030,870Reaching for the ears with crossed arms-0,170,313Finger-riger test0,240,128Finger-opposition test0,280,075Total outcome0,240,28On the cars with crossed arms-0,170,313Stinger-opposition test0,280,075Total outcome0,240,128	Total outcome	0,18	0,267
Catching a ball0,040,799Skipping gait (light hops on each foot)0,140,402Leaping like a frog0,110,496Slow and fast pronation/supination with arms extended in front0,010,973Flexion and extension of wrists-0,070,648Sitting up from supine without the help of the arms-0,010,944Hopping on the right or left leg0,230,155Standing on right and left leg (eyes open)0,260,110Standing on right and left leg (eyes closed)0,040,783Knee-heel test in supine with the eyes open and closed-0,050,745Total outcome0,040,790Diadochkinesis with closed eyesRight-left arm pronation and supination with fast alternating movements0,080,627Finger-nose test0,030,870Reaching for the ears with crossed arms-0,170,313Finger-opposition test0,280,075Total outcome0,240,128	Movement coordina	ation	
Skipping gait (light hops on each foot)0,140,402Leaping like a frog0,110,496Slow and fast pronation/supination with arms extended in front0,010,973Flexion and extension of wrists-0,0070,648Sitting up from supine without the help of the arms-0,010,944Hopping on the right or left leg0,230,155Standing on right and left leg (eyes open)0,260,110Standing on right and left leg (eyes closed)0,040,783Knee-heel test in supine with the eyes open and closed-0,050,745Total outcome0,040,790Diadochokinesis with closed eyesRight-left arm pronation and supination with fast alternating movements0,030,870Finger-nose test0,030,870Reaching for the ears with crossed arms-0,170,313Finger-opposition test0,240,128Finger-opposition test0,280,075Total outcome0,040,808	Catching a ball	0,04	0,799
Leaping like a frog0,110,496Slow and fast pronation/supination with arms extended in front0,010,973Flexion and extension of wrists-0,070,648Sitting up from supine without the help of the arms-0,010,944Hopping on the right or left leg0,230,155Standing on right and left leg (eyes open)0,260,110Standing on right and left leg (eyes closed)0,040,783Knee-heel test in supine with the eyes open and closed-0,050,745Total outcome0,040,790Diadochokinesis with closed eyesRight-left arm pronation and supination with fast alternating movements0,030,870Finger-nose test0,030,870Reaching for the ears with crossed arms-0,170,313Finger-finger test0,280,075Total outcome0,280,075	Skipping gait (light hops on each foot)	0,14	0,402
Slow and fast pronation/supination with arms extended in front0,010,973Flexion and extension of wrists-0,070,648Sitting up from supine without the help of the arms-0,010,944Hopping on the right or left leg0,230,155Standing on right and left leg (eyes open)0,260,110Standing on right and left leg (eyes closed)0,040,783Knee-heel test in supine with the eyes open and closed-0,050,745Total outcome0,040,790Diadochokinesis with closed eyesRight-left arm pronation and supination with fast alternating movements0,030,870Finger-nose test0,030,870Reaching for the ears with crossed arms-0,170,313Finger-finger test0,240,128Finger-opposition test0,280,075Total outcome0,040,808	Leaping like a frog	0,11	0,496
Flexion and extension of wrists-0,070,648Sitting up from supine without the help of the arms-0,010,944Hopping on the right or left leg0,230,155Standing on right and left leg (eyes open)0,260,110Standing on right and left leg (eyes closed)0,040,783Knee-heel test in supine with the eyes open and closed-0,050,745Total outcome0,040,790Diadochokinesis with closed eyesRight-left arm pronation and supination with fast alternating movements0,030,870Finger-nose test0,030,870Reaching for the ears with crossed arms-0,170,313Finger-finger test0,240,128Finger-opposition test0,280,075Total outcome0,040,808	Slow and fast pronation/supination with arms extended in front	0,01	0,973
Sitting up from supine without the help of the arms-0,010,944Hopping on the right or left leg0,230,155Standing on right and left leg (eyes open)0,260,110Standing on right and left leg (eyes closed)0,040,783Knee-heel test in supine with the eyes open and closed-0,050,745Total outcome0,040,790Diadochokinesis with closed eyesRight-left arm pronation and supination with fast alternating movements0,080,627Finger-nose test0,030,8700,313Finger-finger test0,240,1280,075Total outcome0,280,0750,04	Flexion and extension of wrists	-0,07	0,648
Hoping on the right or left leg0,230,155Standing on right and left leg (eyes open)0,260,110Standing on right and left leg (eyes closed)0,040,783Knee-heel test in supine with the eyes open and closed-0,050,745Total outcome0,040,790Diadochokinesis with closed eyesRight-left arm pronation and supination with fast alternating movements0,080,627Finger-nose test0,030,870Reaching for the ears with crossed arms-0,170,313Finger-finger test0,240,128Finger-opposition test0,240,075Total outcome0,040,808	Sitting up from supine without the help of the arms	-0,01	0,944
Standing on right and left leg (eyes open)0,260,110Standing on right and left leg (eyes closed)0,040,783Knee-heel test in supine with the eyes open and closed-0,050,745Total outcome0,040,790Diadochokinesis with closed eyesRight-left arm pronation and supination with fast alternating movements0,080,627Finger-nose test0,030,870Reaching for the ears with crossed arms-0,170,313Finger-finger test0,240,128Finger-opposition test0,040,808	Hopping on the right or left leg	0,23	0,155
Standing on right and left leg (eyes closed)0,040,783Knee-heel test in supine with the eyes open and closed-0,050,745Total outcome0,040,790Diadochokinesis with closed eyesRight-left arm pronation and supination with fast alternating movements0,080,627Finger-nose test0,030,870Reaching for the ears with crossed arms-0,170,313Finger-finger test0,240,128Finger-opposition test0,280,075Total outcome0,040.808	Standing on right and left leg (eves open)	0,26	0,110
Knee-heel test in supine with the eyes open and closed-0,050,745Total outcome0,040,790Diadochokinesis with closed eyesRight-left arm pronation and supination with fast alternating movements0,080,627Finger-nose test0,030,870Reaching for the ears with crossed arms-0,170,313Finger-finger test0,240,128Finger-opposition test0,280,075Total outcome0,040.808	Standing on right and left leg (eves closed)	0.04	0,783
Total outcome0,040,790Diadochokinesis with closed eyesRight-left arm pronation and supination with fast alternating movements0,080,627Finger-nose test0,030,870Reaching for the ears with crossed arms-0,170,313Finger-finger test0,240,128Finger-opposition test0,280,075Total outcome0,040.808	Knee-heel test in supine with the eves open and closed	-0.05	0,745
Diadochokinesis with closed eyes 0,02 0,027 Right-left arm pronation and supination with fast alternating movements 0,08 0,627 Finger-nose test 0,03 0,870 Reaching for the ears with crossed arms -0,17 0,313 Finger-finger test 0,24 0,128 Finger-opposition test 0,28 0,075 Total outcome 0,04 0.808	Total outcome	0.04	0,790
Right-left arm pronation and supination with fast alternating movements0,080,627Finger-nose test0,030,870Reaching for the ears with crossed arms-0,170,313Finger-finger test0,240,128Finger-opposition test0,280,075Total outcome0,040.808	 Diadochokinesis with cl	osed eves	-,
Finger-nose test0,030,870Reaching for the ears with crossed arms-0,170,313Finger-finger test0,240,128Finger-opposition test0,280,075Total outcome0.040.808	Right-left arm pronation and supination with fast alternating movements	0,08	0,627
Reaching for the ears with crossed arms-0,170,313Finger-finger test0,240,128Finger-opposition test0,280,075Total outcome0.040.808	Finger-nose test	0.03	0.870
Finger-finger test0,240,128Finger-opposition test0,280,075Total outcome0.040.808	Reaching for the ears with crossed arms	-0.17	0.313
Finger-opposition test0,280,075Total outcome0.040.808	Finger-finger test	0.24	0 128
Total outcome 0.04 0.808	Finger-opposition test	0.28	0.075
	Total outcome	0.04	0.808

TABLE 9: Evaluation of correlation with gestation time.

R: correlation; *p*: test probability value.

introduce more efficient consultation and timely intervention.

The objective of this study was to determine whether children born before 30 weeks of pregnancy, who seemed to be free of serious neurological disorders, would develop similar growth patterns and neurodevelopmental performance at preschool age, compared with their full-term peers.

One of the diagnostic methods, suitable for children with motor development disorders, which was used in this study, was Touwen neurological examination. This is a standardized and age-specific assessment tool that focuses on the presence of minor neurological dysfunction.

The results of the recent study demonstrate that a significant amount of apparently normal preterm children had worse motor and functional performance at preschool age than their full-term peers [17].

In the scientific studies concerning motor development of preterm children, the incidence of motor impairment is reported to vary from 9.5 to 51% [22–28]. These children may also exhibit other learning difficulties. Several studies have attempted to assess if motor impairments are being associated with learning impairments in preterm children. Motor impairments are definitely associated with intellectual estimations of both the visual and verbal domains [22]. When children with motor impairments are compared with their full-term peers, differences are seen in a wide variety of performed intellectual and academic tasks [23, 24].

Analysis of the relationship between the duration of pregnancy and the results of the individual tests showed that the degree of prematurity affects, in a statistically significant way, only the results of the three tests in the hand function subcategory. However, the strength of these correlations was moderate. It has been reported by de Kieviet et al. that gestational age is related to delayed motor performance occurring during early developmental period in children under 5 years of age [29].

Defining mild neuromotor impairments at preschool age, as a valid marker of long-term impairments, allows proactive support and prospective allocation of resources to be directed to those who are most likely to struggle with future problems and limitations in personal, social, and academic life.

6. Conclusion

The results of our study indicate that the nondisabled, preterm children have lower average outcomes concerning hand function, quality of walking, muscle tone, coordination, and diadochokinesis at the age of six to seven, compared to their full-term peers. It seems that, with time, these particular children may be prone to emerging problems in the future. Therefore, ongoing screening of these children seems to be essential. Involvement of nondisabled, preterm children in appropriate intervention programs may facilitate their optimal development, maintain adequate motor performance, and minimize the development of long-term impairments.

Conflicts of Interest

The authors declare that there are no conflicts of interest regarding the publication of this paper.

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