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# PROBLEMS OF MOTOR SKILLS DEVELOPMENT OF CHILDREN WITH MILD MENTAL DISORDER

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### *Abstract*

The development of motor skills corresponds with the cognitive development of a child. In motor learning, the acquisition, refinement and stabilization of motor skills is achieved. Children with mild mental disorder are nowadays included in the intact population as part of compulsory school education. Will be found statistically significant differences between group of intact children and children with mild mental disorder attending compulsory school education? The aim of the research is to describe the primary motor skills, which are an indicator of gross motor development, in children with diagnosed mild mental disorder (MID). The minor aim is to describe the differences between the level of motor skills of children with MID and children from intact population. The experimental group consisted of 62 children primary school age with mild mental disabilities and a control group of 76 children from the intact population primary school age. The level of motor skills was determined by TGMD-2 test. The significance of the difference between the sub-tests and gender differences in the level of motor skills were evaluated by the t-test. Data was collected within the project GF\_PdF\_2019\_0003. A statistically significant difference was found between both sets in the level GMDQ ( $p \leq 0.001$ ) and between locomotor and object control skills of group with mild mental disorder ( $p \leq 0.001$ ). As part of compulsory school attendance, it is necessary to devote individual attention to the development of children's motor skills with diagnosed mild mental disabilities.

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**Keywords:** Child, intellectuall disability, motorics, compulsory school.



## 1. Introduction

Movement, as one of the basic attributes of life, represents a natural and necessary load for the organism. Physical activity is one of those factors that are strongly involved in human phylogenesis and ontogenesis. The changes proceed at the cellular and organ level and are reflected in the improvement of the structure and function of the organ systems. For a child, movement is an irreplaceable factor in shaping, potentiating and regulating development, but it also serves as a certain criterion for controlling the course of dynamic changes in growth and general development. At the same time, the degree of movement evolves and the degree of talent to react independently to new stimuli and situations, which enables, among other things, to get actively involved into interactions with the environment. Disrupting a child from physical activity in the early stages of life, reducing space for physical activity or removing incentives for physical activity disrupts his/ her somato-mental development. Between the ages of 3 and 6, there is a link between the later acquisition of walking skills and atypical development of language abilities (Trauner, Wulfeck, Tallal, & Hesselink, 2000; Karasik, Tamis-LeMonda, & Adolph, 2014; Walle & Campos, 2014; Zwaigenbaum, Bryson, & Garon, 2013). In the pre-school age, a number of important movement schemes are created or further developed, e.g. activities developing the dexterity of the limbs - gripping, lifting, carrying, holding, kicking etc. and activities developing the overall dexterity, rolling, etc.

Motor development is closely related to the development of executive and cognitive functions in both preschool and primary school children (Aadland et al., 2017; Farmer, Golden, & Thurm, 2015; Watson, Crais, Baranek, Dykstra, & Wilson, 2013). If there are problems in the development of motor skills during the child's development, then it is possible to deduce problems in the area of executive functions, coordination, behavior and social adaptability and others (Gammer et al., 2014; Watson et al., 2011). Cognitive impairment is demonstrated by impaired concentration of attention, difficulty in the auditory and visual aspect. The child shows motor clumsiness and visual-motor coordination is impaired (Sugden, Kirby, & Dunford, 2008; Livesey, Keen, Rouse, & White, 2006; Williams, Whiten, & Singh, 2004). The motor behavior of these children is disorganized and discontinuous. The disturbance of executive functions is manifested by the inability to organize an activity, complete a task or game, plan or structure leisure time. There are also disturbances in the perception of chronological and visual-contextual relations, disturbances in verbal expression and impaired verbal and working memory. However, the level of these indicators is usually part of the assessment of the child's readiness for compulsory school education. Deficiencies in these areas are gradually manifested not only in the failure of the child during primary school education, but often also cause low social attractiveness of the child in a group of classmates and contribute to low self-esteem (Adolph & Robinson, 2013; Clearfield, 2011; Oliver, Schofield, Kolt, & McLachlan, 2007; Smith et al., 2013).

Insufficiency of brain functions characterized by decreased level of cognitive processes, different development of some psychic functions and lower social adaptability is called mental disability. According to the International Statistical Classification of Diseases and Related Health Problems (ICD-10, subsection F70) (WHO, 2016), mild mental disorder is the lightest form, which causes, among other things, school problems for a child. Lejčarová (2011) finds differences in psychological development in children with MID far greater than in motor development, which occurs in children with mild mental disorder (further MID) according to the same developmental patterns, only the onset of each stage is later and stay in them

is intact longer population. The motor development of these children is much more linked to cognitive processes and speech than children from the intact population. Early intervention is important to support both motor and cognitive development of the child, as well as appropriate motivation and use of effective educational methods (Bishop, 2014; Houwen, Visser, van der Putten, & Vlaskamp, 2016).

## **2. Problem Statement**

In the Czech Republic, children diagnosed with mild mental disabilities usually attend regular primary schools (Školský zákon, 2017). The act lays down the principles of equal access to education for every citizen of the Czech Republic or another Member State of the European Union without discrimination of any kind, including discrimination on the basis of human health. One of the objectives of compulsory primary school education, set out in the curriculum of education (Rámcový vzdělávací program pro základní vzdělávání, 2017), is to teach children to actively develop and protect their physical health and to be responsible for it. Given the legislation for compulsory education in the Czech Republic and the currently preferred inclusive educational process at primary schools, there is a need for a closer examination of the motor skills of pupils with mild mental disabilities. Although the education of children with MID is regulated by legislation, significant differences in motor development between children with MID and children from an intact population would require further significant adjustments to the curriculum of the compulsory subject Physical Education. The results of a number of researches in this field could serve as a basis for finding forms of education in the implementation of school physical education and meeting its objectives in the context of health promotion education of the youngest age categories.

## **3. Research Questions**

1. Is there a difference in the level of both locomotion and object control skills in children with MID?
2. Will primary school age children diagnosed with MID show gender differences in the level of gross motor skills?
3. Will the differences between children with MID and children from intact population at the level of gross motor skills be confirmed?

## **4. Purpose of the Study**

The main aim of the research is to describe the primary motor skills, which are an indicator of gross motor development, in children with diagnosed mild mental disorder. The minor aim is to describe the differences between the level of motor skills of children with MID and children from intact population.

## **5. Research Methods**

The research group consisted of 62 pupils from primary schools (23 girls, 39 boys) with diagnosed mild mental disorder. Average age of pupils of research group was  $9,66 \pm 0,49$  years (girls  $9,77 \pm 0,56$ , boys  $9,54 \pm 0,42$ ). The research group of children from the intact population consisted of 76 children from primary

schools (38 girls, 38 boys) in average age  $9,67 \pm 0,58$  (girls  $9,82 \pm 0,43$ , boys  $9,53 \pm 0,73$ ). Only children whose legal representatives agreed to participate in the research were included in the research; participation was free of charge and voluntary, at the discretion of parents. They were informed about the aims, methods and realization of the research, the anonymity of the obtained data was declared and the rules of research ethics were observed. Data were collected within the project GF\_PdF\_2019\_0003. The project was authorized by Ethical Committee of author's authorities. The data collection was done in the environment of regular elementary schools. Children were adequately acquainted with the objective of the research, they could interrupt or interrupt their participation at any time. During the testing, children's reactions were monitored and the rules of mental hygiene of activities were observed. The level of motor skills was determined by TGMD-2 test (Ulrich, 2000). The test monitors the level of locomotion and object control motor skills and results are converted in the context of the child's age by a standard score and then to the gross motor development quotient (GMDQ), which is an indicator of the level of motor development. The results of the individual relative to the population are expressed as percentiles. The TGMD-2 test is used in various contexts in the research, but the studies are mostly focused on searching for possibilities to influence gross motor skills (Bardid et al., 2013; Houwen, Hartman, Jonker, & Visscher, 2010). It can also be used in mentally handicapped people (Eguia, Capio, & Simons, 2015). The significance of the difference between the sub-tests (locomotor skills and object control skills) of children with mild mental disorder was evaluated by the t-test. Gender differences in the level of motor skills were evaluated by the Mann-Whitney test. The results were evaluated at the level of statistical significance  $p \leq 0.05$ .

## 6. Findings

In the locomotion skills subtest, subgroup of children with MID achieved a mean score of 4 points. Of the total MID population, more than half of the research group achieved only 1 or 2 standard scores (1–26 points) - the lowest possible TGMD-2 standard score, which equals to 1 percentile of population and age 4, 3 years or less. A total of 23.33 % of children achieved a score of 7–10 (33–41 points), which corresponds to a 16–50 percentile and an age equivalent of 5.0–6.9 years. No proband reached higher values. The maximum achievable standard score in locomotion skills relative to the age of the probands is 13 (corresponding to the 84th percentile), but none of the probands has reached this value (Table 01). Of the group MID 57 % of girls reached the 5th percentile (standard score 1-5; 1-35 points; age equivalent 3-5-5 years) and 43% standard score 6-9 (9-37 percentile), age equivalent is 6, 0–8.6 years (Figure 01). Boys from the MID group had similar results - with a score of 6-9, 42% were evaluated (Figure 02). The difference between girls and boys in locomotion skills was not confirmed ( $p = 0.83$ ). In the object control skills subtest, the MID children achieved a mean score of 3 points. The girls were more successful, but 38% of them achieved a standard score of 1–2 (1–22 points), which corresponds to an age equivalent of 3-4.3 years. Similarly, 39% gained 29-37 points, which is an adequate 5-16 percentile of the population where the achieved object control skills correspond to the age of 5.9-7.2 years. The maximum standard score for girls may reach 15 (47-48 points) at age according to TGMD-2, but this level was not achieved in the group of MID girls (Figure 03, Table 02). Boys in the object control skills subtest ranked mostly in the category below the 1 percentile (66%), with 1–29 points earned corresponding to a score of 1-2. Of the MID boys, 30-34 points received 27% of the respondents, which corresponds to a 1-2 percentile population (Figure

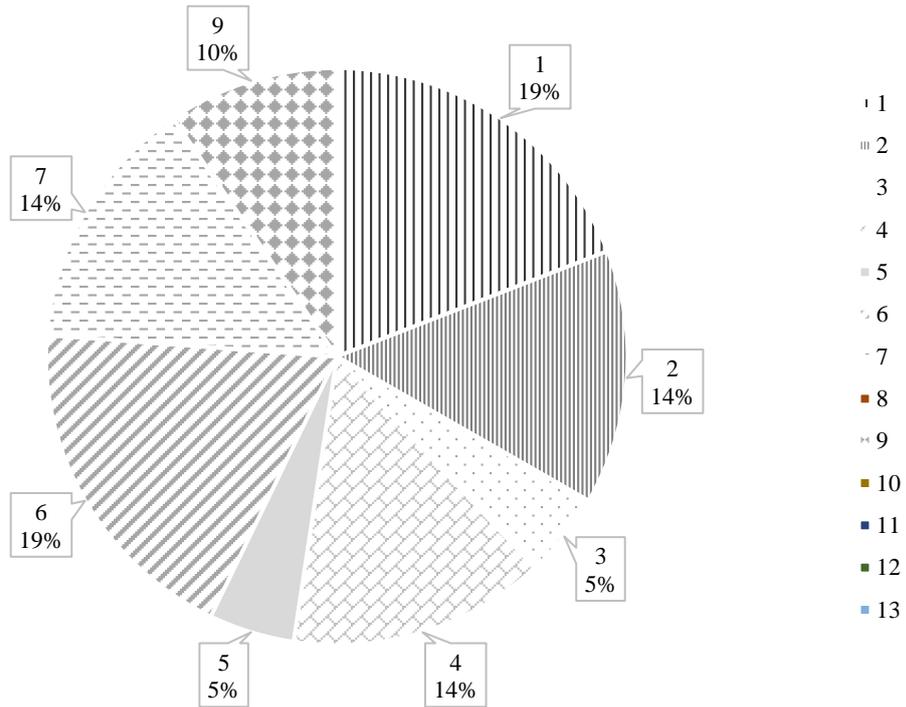
04). Boys at that age could achieve up to 48 points, which corresponds to a score of 13, but no boy achieved a score of 6-13. However, a statistically significant difference between girls and boys in object control skills was not confirmed ( $p = 0.06$ ). Similar results are reported in other studies (Field & Temple, 2017; Jeoung 2013). However, experts highlight the possibility of influencing the results by nuances in the depth of disability of a child with MID and recommend organized physical activities to improve the gross motor skills of children (Vuijk, Hartman, Scherder, & Visscher, 2010; Westendorp, Hartman, Houwen, Smith, & Visscher, 2011). From the point of view of the whole group of children with MID, however, a statistically significant difference was found in the level of locomotor skills and object control skills ( $p \leq 0,001$ ), when the monitored group achieved better results in locomotor skills. Acquisition of basic motor skills such as running, jumping, hopping etc. is a factor that significantly affects the child's involvement in physical activities. It is therefore an important element in the field of health promotion and of course concerns both children from the intact population and children with disabilities (Jaakkola, Yli-Piipari, Huotari, Watt, & Liukkonen, 2015; Loprinzi, Davis, & Fu, 2015; Ross, Case, & Leung, 2016). The total GMDQ of children with MID was 62.47 (boys 59.67; girls 63.21) and therefore falls into the very poor category according to the Descriptive Ratings of Score. In accordance with similar studies, no significant difference was found between girls and boys with MID ( $p = 0.54$ ) when evaluating overall GMDQ (Zikl, Holoubková, Karásková, & Veselíková, 2013; Nonis & Tan, 2014).

The group of children from the intact population (further IP) reached the GMDQ in average of 85.51 (descriptive ratings of scores were in the category below average). Boys showed worse overall results (83.74) than girls (87.29), but no significant difference was confirmed ( $p = 0.09$ ). There were no gender differences in locomotor skills - both groups showed the highest representation in the 7-10 standard score category (38-44 points) (Table 03). The conversion to age equivalent also shows the proportion of probands with slightly delayed motor development (corresponding to the age from 6.5 years). The result corresponds to the trend of gradual decrease in the level of physical activity and preference of sedentary leisure activities already in younger school age, which is confirmed in many countries (Basterfield et al., 2011; Butte et al., 2014). In object control skills girls showed better results than boys, although the difference is not statistically significant ( $p = 0.06$ ). Most girls from the IP group reached a standard score of 7–10 (33–41 points), boys of a standard score of 7–9 (40–43). Unlike girls from IP, the values corresponding to the standard score of 1–3 (1–32 points) were represented in boys. As expected, a significant difference ( $p \leq 0,001$ ) was found in the level of gross motor skills between the MID and IP group. The difference showed in object control skills ( $p \leq 0,001$ ; girls  $p \leq 0,001$ , boys  $p \leq 0,001$ ) and in locomotor skills ( $p \leq 0,001$ ; girls  $p \leq 0,001$ , boys  $p \leq 0,001$ )

**Table 01.** Locomotor skills of group with MID ( $n=62$ ,  $n_{boys}=39$ ,  $n_{girls}=23$ )

Standard Scores locomotor subtest	Percentiles	All [%]	Boys [%]	Girls [%]
1	<1	16,00	8,00	8,00
2	<1	14,00	8,00	6,00
3	1	6,00	3,33	2,00
4	2	16,00	10,00	6,00
5	5	8,00	6,00	2,00
6	9	16,00	8,00	8,00
7	16	12,00	6,00	6,00

8	25	3,33	3,33	0
9	37	6,00	2,00	4,00
10	50	2,00	2,00	0
11	63	0	0	0
12	75	0	0	0
13	84	0	0	0

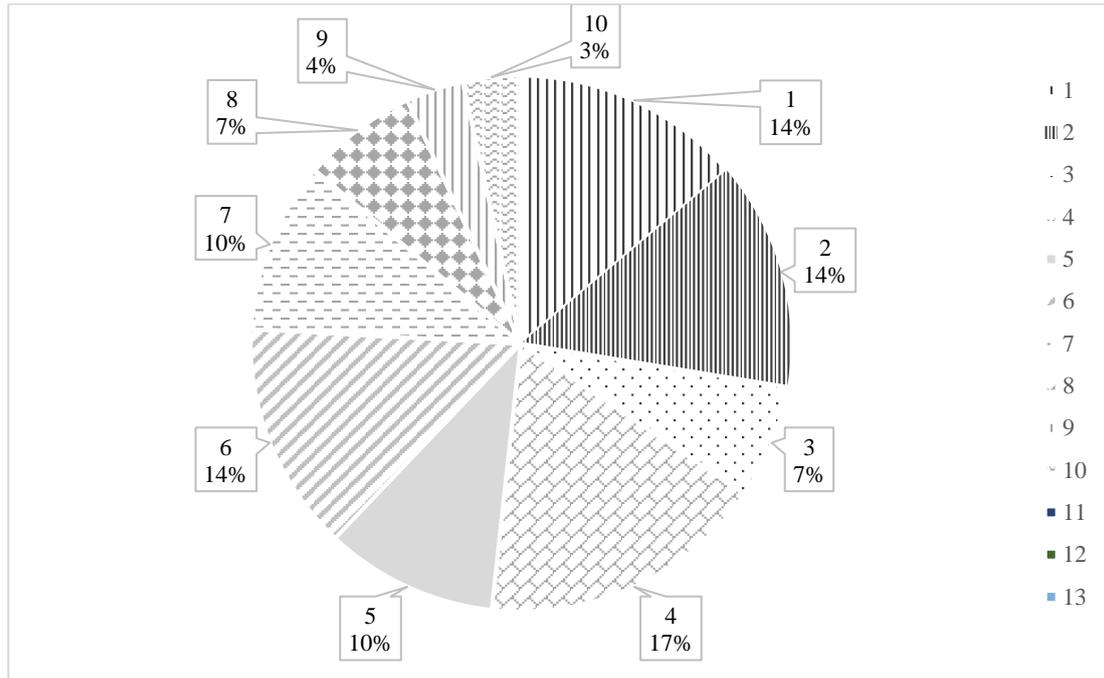


Notes:

1, 2, 3, 4, 5, ... 11 ... standard scores of locomotor skills

8, 10, 11, 12, 13 ... standard scores = 0 % persons

**Figure 01.** Standard Scores of locomotor skills of girls with MID (number of percent) ( $n_{\text{girls}}=23$ )

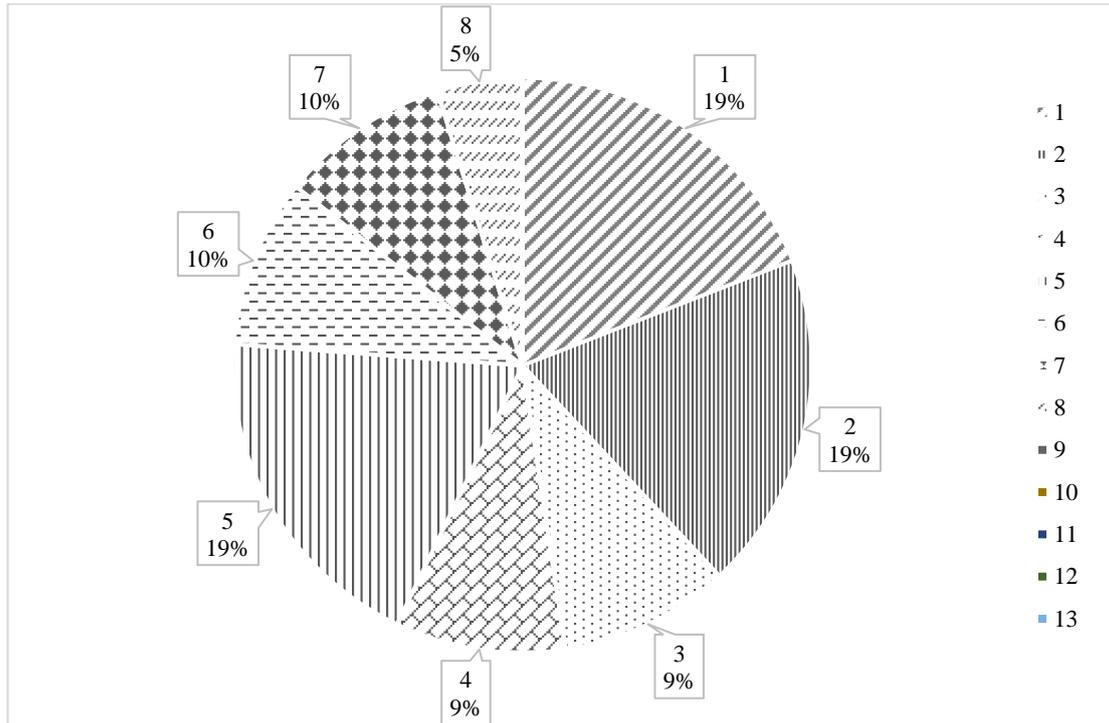


Notes:  
 1, 2, 3, 4, 5, ..., 10 ... standard scores of locomotor skills  
 11, 12, 13 ... standard scores = 0 % persons

**Figure 02.** Standard Scores of locomotor skills of boys with MID (number of percent) ( $n_{\text{boys}}=39$ )

**Table 02.** Object control skills of group with MID ( $n=62$ )

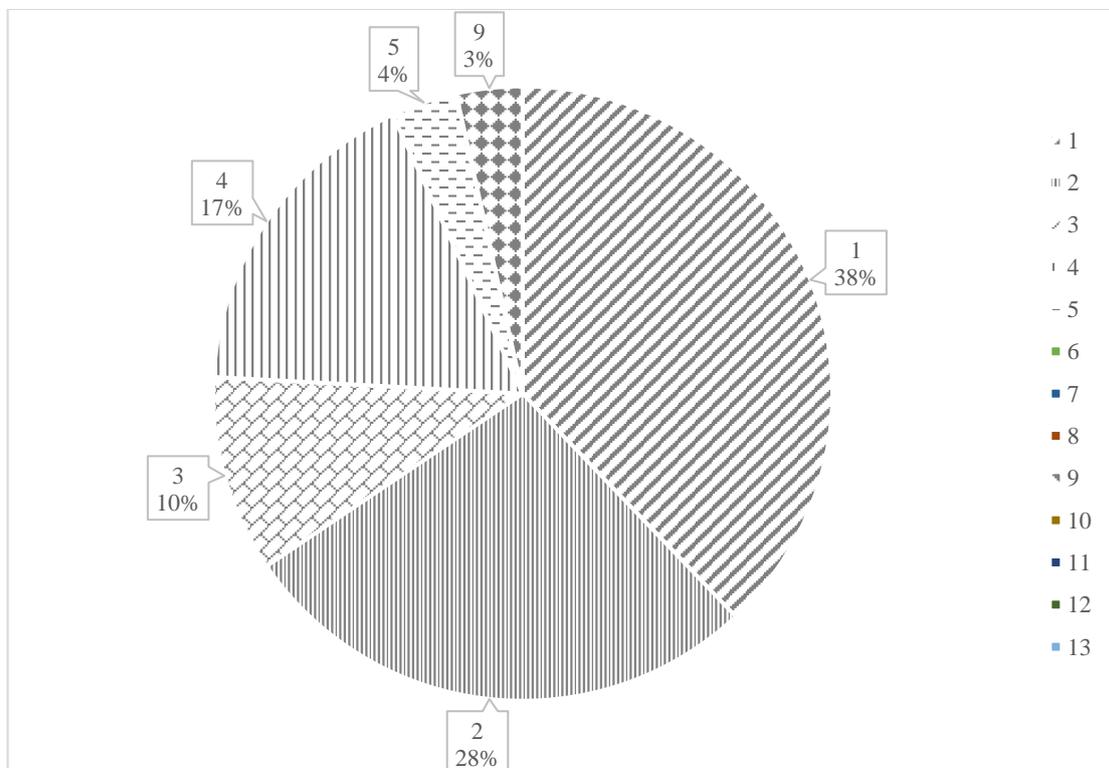
Standard Scores object control subtest	Percentiles	All [%]	Boys [%]	Girls [%]
1	<1	32,00	22,00	8,00
2	<1	24,00	16,00	8,00
3	1	10,00	6,00	4,00
4	2	14,00	10,00	4,00
5	5	10,00	2,00	8,00
6	9	4,00	0,00	4,00
7	16	4,00	0,00	4,00
8	25	0,00	0,00	2,00
9	37	2,00	2,00	0,00
10	50	0	0,00	0,00
11	63	0	0,00	0,00
12	75	0	0,00	0,00
13	84	0	0,00	0,00
14	91	0	-	0
15	95	0	-	0



Notes:

1, 2, 3, 4, 5,... ... standard scores of object control skills; 9, 10, 11, 12, 13, 14, 15 ... standard scores = 0 % persons

**Figure 03.** Standard Scores of object control skills of girls with MID (number of percent) ( $n_{\text{girls}}=23$ )



Notes:

1, 2, 3, 4, 5,... ... standard scores of object control skills; 6, 7, 8, 10, 11, 12, 13 ... standard scores = 0 % persons

**Figure 04.** Standard Scores of object control skills of boys with MID (number of percent) ( $n_{\text{boys}}=39$ )

**Table 03.** Locomotor skills of group from IP (n=76)

Standard Scores locomotor subtest	Percentiles	All [%]	Boys [%]	Girls [%]
1	<1	0	0	0
2	<1	0	0	0
3	1	2,63	2,63	0
4	2	0	0	0
5	5	3,95	1,32	2,63
6	9	6,58	3,95	2,63
7	16	14,47	7,9	6,58
8	25	27,63	13,16	14,47
9	37	25	11,84	13,16
10	50	13,16	6,58	6,58
11	63	3,95	1,32	2,63
12	75	1,32	1,32	0
13	84	1,32	0	1,32

**Table 04.** Object control skills of group from IP (n=76)

Standard Scores object control subtest	Percentiles	All [%]	Boys [%]	Girls [%]
1	<1	0	0	0
2	<1	0	0	0
3	1	2,63	2,63	0
4	2	0	0	0
5	5	3,95	1,32	2,63
6	9	6,58	3,95	2,63
7	16	14,47	7,9	6,58
8	25	27,63	13,16	14,47
9	37	25	11,84	13,16
10	50	13,16	6,58	6,58
11	63	3,95	1,32	2,63
12	75	1,32	1,32	0
13	84	1,32	0	1,32
14	91	0	-	0
15	95	0	-	0

## 7. Conclusion

The development of motor skills and its impact on the school success of a child is a current subject of many researches. If problems are detected in the right time, it would be possible to intervene with appropriate education programs in early age categories and prepare the child for compulsory school education. A significant difference was found between the level of locomotor and object control skills in the group of children with MID in favor of locomotion skills. Gender differences in children with MID have not been confirmed in terms of locomotor or object control skills. However, significant differences in the level of motor skills were found between children with MID and children from IP, and it can be assumed that in preferred inclusive education, a lower level of motor skills may affect the success of a child in compulsory education. Supporting the development of gross motor skills in children with MID could help adapt to compulsory school education and facilitate integration into the group of classmates, as well as

greater involvement in leisure activities with peers from the intact population. Motor skills problems must also be taken into account during basic education, where physical and health education is a compulsory subject. Teachers should individually develop the motor skills of children with mild mental disabilities, search and develop methods and procedures for working with children with this type of disability.

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