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Article *in* Journal of Intellectual Disability Research · November 2010

Impact Factor: 2.41 · DOI: 10.1111/j.1365-2788.2010.01318.x · Source: PubMed

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Journal of Intellectual Disability Research doi: 10.1111/j.1365-2788.2010.01318.x

VOLUME 54 PART 11 pp 955–965 NOVEMBER 2010

Motor performance of children with mild intellectual disability and borderline intellectual functioning

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Abstract

Background There is a relatively small body of research on the motor performance of children with mild intellectual disabilities (MID) and borderline intellectual functioning (BIF). Adequate levels of motor skills may contribute to lifelong enjoyment of physical activity, participation in sports and healthy lifestyles. The present study compares the motor skills of children with intellectual disability (ID) to the abilities observed in typically developing children. It also aimed to determine whether there is an association between degree of ID and motor performance.
Methods A total of 170 children between 7 and 12 years old with MID or BIF, who attended schools for special education, were examined on the test component of the Movement Assessment Battery for Children (MABC) test. Both groups were compared with the norm scores of the total score, sub-scale scores and individual items of the MABC test.
Results Of the children, 81.8% with MID and 60.0% with BIF performed below the 16th percentile on the total score of the MABC. Both groups demonstrated a relative weakness in the area of manual dexterity. Comparisons between both groups showed small to moderate effect sizes on the total score of the MABC, as well as for all three sub-scales, favouring the children with BIF.
Conclusions Children with ID had significantly more borderline and definite motor problems than the normative sample and there was an association between degree of ID and performance of manual dexterity, ball skills and balance skills. This study highlights the importance of improving motor skill performance in both children with borderline and mild ID, and the results support the notion that the level of motor and cognitive functioning are related in children with ID.

Keywords atypical brain development, borderline intellectual functioning, mild intellectual disability, motor performance, Movement Assessment Battery for Children

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Introduction

The American Association on Intellectual and Developmental Disorders (formerly known as American Association on Mental Retardation) defines intellectual disability (ID), previously referred to as mental retardation, as 'characterized by significant limitations both in intellectual functioning and in adaptive behavior expressed in conceptual, social, and practical adaptive skills. This disability originates before the age of 18.' (Schalock *et al.* 2007, p. 118). Pratt & Greydanus (2007) elaborated on this definition by stating that individuals with ID have limitations in developmental skills in several domains of functioning including cognitive, motor, auditory, language, psychosocial, moral judgment and specific integrative adaptive activities of daily living. Even though deficits in motor functioning are mentioned above, there is surprisingly little research in this domain on individuals with ID, particularly children with ID. When considering that adequate levels of motor skills may contribute positively to activities of daily living (Watkinson *et al.* 2001), lifelong enjoyment of physical activity, participation in sports (Wall 2004; Krombholz 2006) and less sedentary behaviour (Wrotniak *et al.* 2006), it is important that motor functioning in children with ID is examined.

Previous research has focused mostly on ID with a known aetiology, such as Down syndrome (i.e. Vicari 2006), Williams syndrome (i.e. Tsai *et al.* 2008) and children with a more profound ID (i.e. Van der Putten *et al.* 2005), but not on children with a mild intellectual disability (MID), defined as children with an intelligence quotient (IQ) score between 50 and 70 (American Psychiatric Association 2000). This limited body of research is particularly striking considering that the estimations of the prevalence of MID is around 3.4% (Roeleveld *et al.* 1997).

Some early research, that focused on children with MID, showed delays in the development of motor skills (Francis & Rarick 1959; Rarick 1973; Bouffard 1990). For example, children with MID appear to be 3–5 years behind in gross and fine motor skills in comparison with typical functioning children of the same age (Rarick 1973). Hagberg *et al.* (1981) found that 23% of the children in a group of Swedish school children with MID were identified with 'clumsy child syndrome' (a former term for children with motor impairment; i.e. Sigmundsson 2005). Savage (2007) examined a group of children with ID (IQ < 70) on two motor tasks from the dyslexia screening test (Fawcett & Nicolson 1996). The first motor task was bead threading that was used as a measure of dynamic cerebellar functioning and the second task was postural stability that was used as a measure of static cerebellar functioning. The scores for children with ID were below the normative scores on bead threading but not on the postural stability task. The lack of effect in the second task may be attributed to the fact that the postural stability task is a qualitative measure of balance, which may very well differentiate less compared with the more quantitative measure of fine motor skills found in bead threading. More recently, Wuang *et al.* (2008) examined a total of 233 children with MID aged 7–8 years on 22 measures of sensorimotor functioning. Around 44% of the children scored in the impaired range on seven out of 22 measures.

The limited body of research on motor performance in children with MID also applies to children with borderline intellectual functioning (BIF), which includes children with an IQ between 71 and 84 (American Psychiatric Association 2000). Although this is a significantly large group of children, comprising up to 7% of the school age population (Karande *et al.* 2008), there is similarly little research in this area (Ninivaggi 2001; Kaznowski 2004), and little research specifically on children with BIF and their motor functioning. Two studies have addressed motor functioning in children with BIF (Hetrick 1979; Karande *et al.* 2008). In the former study, children with BIF performed poorly compared with typically functioning peers of the same chronological age on the Bender visual–motor task (Koppitz 1964). In the latter study, of a group of 55 children with BIF, 27.3% showed delays in walking and 92.7% demonstrated difficulty with writing.

All the studies above compared a group of intellectually disabled individuals against the norms of the general population, a sample of individuals whose intellectual function is within normal limits or typically functioning individuals with an isolated learning disability (LD). Considering the relatively small body of research on motor functioning of children with ID, we wanted to explore two new approaches. First, we compared two groups of children who are adjacent to each other in the spectrum of intellectual functioning, one with MID and the other with BIF, with the norms of the general population. These groups of children with slightly different intellectual functioning were assessed on all eight items of the MABC thus creating a broad view of their status of motor development. Second, the groups were compared with each other in an attempt to get an insight into potential differences in motor development between these two groups. In typically developing individuals a relationship between the acquisition of motor milestones and subsequent cognitive functioning at the ages 8, 26 and 53 has been observed (Murray *et al.* 2007). Murray *et al.* suggested that the mechanism explaining their results was a suboptimal cortical–subcortical connectivity. Another study, by Reiss *et al.* (1996), also suggested a relationship between cognitive functioning and particular brain areas. Using a brain imaging study, they found that IQ was positively correlated with cerebral volume in children, in particular with cortical grey matter in the prefrontal region of the brain. Based on their results, we expected to find a difference in motor development between the MID and BIF group favouring the latter group. A possible difference in motor functioning between children with MID and BIF would suggest an extension of the atypical brain development (ABD) concept by Kaplan *et al.* (1998). ABD is a conceptual framework for understanding developmental LDs and its high co-morbidity with other developmental disorders, such as developmental coordination disorder (DCD), pervasive developmental disorder – not otherwise specified (PDD-NOS) and attention deficit hyperactivity disorder (ADHD), by claiming that the aetiology of developmental disorders is an atypical functioning of the brain. At this time, ID is not included in this framework. A lower degree of intellectual functioning would mean a higher degree of motor impairment. In order to examine these hypotheses using an ecologically valid sample with regard to variety in intelligence and co-morbidity we recruited children from two elementary schools for special education.

Methods

Participants

We recruited 190 children with ID from two elementary special needs schools in the northern regions of the Netherlands. Twenty children who were ill during the measurements and children without informed consent from their parents were excluded. The final study population included 170 children aged 7–12 (109 boys, 61 girls; mean age 10.0 years, standard deviation 1.4 years) (Table 1). IQ scores, extracted from the personal files of the children, were used to classify the children into MID ($50 \leq IQ \leq 70$, $n = 55$) and BIF groups ($71 \leq IQ \leq 84$, $n = 115$) according to the Diagnostic and Statistical Manual of Mental Disorder IV Text Revision (American Psychiatric Association 2000). Forty-four children across both groups were also diagnosed with PDD-NOS and 30 children with ADHD. The groups did not statistically differ from

Table 1 Characteristics of the children with mild intellectual disability (MID) and borderline intellectual functioning (BIF)

	MID (n = 55)	BIF (n = 115)	Test statistic	
	Mean (SD)	Mean (SD)	t (168)	*P*-value
Age	9.93 (1.41)	10.06 (1.37)	0.59	0.56
IQ	65.27 (4.56)	77.38 (4.12)	17.32	<0.001
	Frequencies	Frequencies	$\chi^2_{(1)}$	
Gender (boys/girls)	35/20	74/41	0.01	0.93
ADHD (yes/no)	6/49	24/91	2.54	0.11
PDD-NOS (yes/no)	14/41	30/85	0.01	0.93

ADHD, attention deficit hyperactivity disorder; IQ, intelligence quotient; PDD-NOS, pervasive developmental disorder – not otherwise specified; SD, standard deviation.

each other on age, gender, % ADHD or % PDD-NOS. Informed consent for the children's participation was obtained from the parent(s) and all procedures were in accordance with the ethical standards of the Faculty of Medical Sciences of the University Medical Centre Groningen, University of Groningen.

Materials

In order to assess motor performance, the test component of the Movement Assessment Battery for Children (MABC; 1st edition) was applied (Henderson & Sugden 1992). We used the MABC as it is a standard exam used worldwide for the evaluation of children with movement difficulties (Smits-Engelsman *et al.* 1998, 2008). Smits-Engelsman *et al.* (1998) showed that the norms of the MABC are satisfactory for Dutch children. In this study, the Dutch validated version was used (Smits-Engelsman 1998).

The MABC consists of four age-related item sets (4–6, 7–8, 9–10 and 11–12 years). Each age band consists of eight items, which are assessed under the following sub-scales: manual dexterity (three items), ball skills (two items) and static and dynamic balance (three items). Some items are performed with the preferred hand as well as the non-preferred hand. Hand preference can be defined as the hand the child uses for writing (Henderson & Sugden 1992). Each item is scored on a scale from 0 to 5. Summing the item scores for every subtest provides a sub-scale score. The manual dexterity score varies from 0 to 15; the ball skill subtest score from 0 to 10; and the static and dynamic balance subtest score from 0 to 15. Sub-scale scores can be summed to give a total score for motor development ranging from 0 to 40. High scores indicate poor motor performance.

The total score on the MABC, as well as the sub-scale scores and item scores were converted into percentile scores that reflected the child's level of performance in comparison with children in the normative population. Children with a score between the 100th and 16th percentile were regarded as having 'no motor problems', 15th to 6th percentile as having 'borderline motor problems' and the 5th percentile and below as having 'definite motor problems'.

The MABC has acceptable validity and reliability in children from regular schools and schools for special education (Henderson & Hall 1982; Lam & Henderson 1987; Van Waelvelde *et al.* 2004). Inter-rater reliability ranges from 0.70 to 0.89 and the test–retest reliability is 0.75 (Henderson & Sugden 1992). The MABC has been used in a wide range of study populations, such as children with Down syndrome (Spano *et al.* 1999), children with LDs (Van Waelvelde *et al.* 2004), children born prematurely (Jongmans *et al.* 1997), deaf children (Gheysen *et al.* 2008) and children with visual impairments (Houwen *et al.* 2008).

Procedure

The items of the MABC were administered individually by master students in Human Movement Science. The test leaders were thoroughly trained in the test before the data collection (training included familiarisation with all procedures and scoring methods). MABC testing was carried out according to the manual of this test. Appropriate age bands were used for all children. Within the MID group 12 children completed the items of age band 2, 17 children the items of age band 3 and 26 children the items of age band 4. Within the BIF group, 16 children completed the items of age band 3, 52 children completed the items of age band 3 and 47 children completed the items of age band 4. There was no statistical difference in the distribution of the children over the three different age bands across groups ($\chi^2_{(2)} = 3.64$; $P = 0.16$).

Data analysis

Data analysis was conducted using SPSS for Windows 15.0. The motor performance of the children was classified as 'no motor problems', 'borderline motor problems' (below the 15th percentile) or 'definite motor problems' (below the 5th percentile) in comparison with the percentage expected in a normal population. This was done for the total score and the sub-scales of the MABC as well as for the individual items. The distribution of the classifications in our sample was tested by use of a χ^2-test. To examine the difference on motor performance between the children with MID and children

Table 2 Motor profile of children with MID ($n = 55$) and BIF ($n = 115$) on the total score, the sub-scales and the separate items of the MABC compared with the distribution of the normative sample

	No motor problems (%)	Borderline motor problems (%)	Definite motor problems (%)	$\chi^2_{(2)}$	*P*-value
Total MABC					
MID	18.2	20.0	61.8	389.50	<0.001
BIF	40.0	17.4	42.6	359.00	<0.001
Manual dexterity					
MID	29.1	18.2	52.7	274.48	<0.001
BIF	43.5	14.8	41.7	336.40	<0.001
Speed and accuracy of each hand separately					
MID	27.3	47.3	25.5	144.00	<0.001
BIF	38.3	29.6	32.2	243.41	<0.001
Bimanual coordination					
MID	49.1	16.4	34.5	106.59	<0.001
BIF	73.0	9.6	17.4	37.27	<0.001
Eye–hand coordination					
MID	32.7	23.6	43.6	192.11	<0.001
BIF	42.6	24.3	33.0	228.87	<0.001
Ball skills					
MID	36.4	27.3	36.4	139.92	<0.001
BIF	55.7	24.3	20.0	87.08	<0.001
Catching a moving object					
MID	52.7	25.5	21.8	50.99	<0.001
BIF	71.3	11.3	17.4	38.05	<0.001
Aiming at a goal					
MID	50.9	29.1	20.0	52.32	<0.001
BIF	64.3	22.6	13.0	38.93	<0.001
Balance					
MID	36.4	34.5	29.1	112.28	<0.001
BIF	55.7	20.9	23.5	103.77	<0.001
Static balance					
MID	27.3	45.5	27.3	145.27	<0.001
BIF	34.8	40.9	24.3	229.80	<0.001
Dynamic balance while moving fast					
MID	30.9	34.5	34.5	148.09	<0.001
BIF	43.5	32.2	24.3	165.97	<0.001
Dynamic balance while moving slowly					
MID	72.7	12.7	14.5	11.41	0.003
BIF	82.6	6.1	11.3	10.98	0.004

BIF, borderline intellectual functioning; MABC, Movement Assessment Battery for Children; MID, mild intellectual disability.

with BIF, the non-parametric Mann–Whitney *U*-test was used. Correlational effect size statistics were calculated for each dependent variable by dividing the *z*-score by the square root of the sample size (Rosenthal 1991). An effect size of $r = 0.10$ was defined as small, $r = 0.30$ as medium and $r = 0.50$ as large (Field 2005). For all analyses, a statistical significance level of 0.05 was used.

Results

Motor profile of children with MID on the total and sub-scale scores of the MABC

The χ^2-tests in Table 2 revealed that the proportion of children with MID with borderline or definite motor problems differed significantly from the normative population. It shows that 20.0% of the

Table 3 Comparisons of children with mild intellectual disability (MID) and borderline intellectual functioning (BIF) on the total and sub-scale scores of the MABC

Total score and sub-scales	MID (*n* = 55)				BIF (*n* = 115)						
	Mean	SD	Median	Range	Mean	SD	Median	Range	z	*P*	Effect size
Total MABC	17.13	7.95	15	4–36.50	13.41	8.27	12	0–38	–2.96	0.003	0.23
Manual dexterity	7.30	3.77	6.5	0.50–15	5.94	3.81	5.50	0–14.50	–2.14	0.032	0.16
Ball skills	3.68	2.94	3	0–10	2.63	2.81	2	0–10	–2.43	0.015	0.19
Balance	6.15	3.74	5.5	0–15	4.84	3.44	4	0–15	–2.26	0.024	0.17

MABC, Movement Assessment Battery for Children; SD, standard deviation.

children with MID had borderline motor problems and 61.8% had definite motor problems as measured by the total score on the MABC. Examination of the sub-scales showed that 70.9% of the children had borderline or definite motor problems on the sub-scale manual dexterity and 63.6% of the children on the sub-scales ball skills and balance.

Motor profile of children with BIF on the total and sub-scale scores of the MABC

Children with BIF also had a motor profile that differed from the normative sample as indicated by the χ^2-tests in Table 2, with 17.4% of the children had borderline motor problems and 42.6% had definite motor problems as indicated by the total score on the MABC. Examination of the sub-scales showed that 56.5% of the children had borderline or definite motor problems on the sub-scale manual dexterity and 44.3% of the children on the sub-scales ball skills and balance.

Motor profile of children with MID on the item scores of the MABC

Within the sub-scale manual dexterity, the items 'speed and accuracy of each hand separately' and 'eye–hand coordination' showed more children with borderline or definite motor problems, respectively, 72.7% and 67.3%, compared with 50.9% of the children on 'bimanual coordination' (Table 2). Within the sub-scale ball skills, 47.3% and 49.1% of the children had borderline or definite motor problems on the items 'catching a moving object' and 'aiming at a goal'.

Finally, on the sub-scale static and dynamic balance, 72.7% and 69.1% of the children had borderline or definite motor problems on 'static balance' and 'dynamic balance (fast)' and 27.3% of the children on the item 'dynamic balance (slow)'.

Motor profile of children with BIF on the item scores of the MABC

Within the sub-scale manual dexterity, the items 'speed and accuracy of each hand separately' and 'eye–hand coordination' showed more children with borderline or definite motor problems, respectively, 61.7% and 57.4%, compared with 27.0% of the children on 'bimanual coordination' (Table 2). On the items of the sub-scale ball skills 28.7% and 35.7% of the children demonstrated borderline or definite motor problems with 'catching a moving object' and 'aiming at a goal'.

Finally on the sub-scale static and dynamic balance, 65.2% and 56.5% of the children had borderline or definite motor problems on, respectively, 'static balance' and 'dynamic balance (fast)' and 17.4% of the children on the item 'dynamic balance (slow)'.

Comparisons between children with MID and BIF on total and sub-scale scores of the MABC

Table 3 shows that children with MID scored significantly higher (i.e. more poorly) than children with BIF for the total score on the MABC ($P = 0.003$, $r = 0.23$), manual dexterity ($P = 0.032$, $r = 0.16$), ball skills ($P = 0.015$, $r = 0.19$) and balance

($P = 0.024$, $r = 0.17$). The effect size statistics indicated small-to-moderate effects.

Discussion

The present study consisted of two parts. First, we investigated the degree of motor impairment in children with MID and children with BIF (all attending schools for special education) compared with the normative population. Second, we searched for differences between children with MID and children with BIF on motor performance. The first part of the study showed that after combining the percentages of the children with borderline motor problems and definite motor problems, 81.8% of the children with MID had some degree of motor problems as compared with 60.0% of the children with BIF. These percentages are considerably higher than the 50% co-morbidity rates found between children with LDs and children with DCD (Lyytinen & Ahonen 1989; Kaplan *et al.* 2001). In the Netherlands, children with LDs attend the same schools of special education as the children in our sample. This would suggest that schools for special education should recognise that their students are not all functioning at the same motor level and physical education classes may be modified to address each child at his own level of motor functioning.

Comparison of the sub-scales of the MABC showed that manual dexterity was relatively the most difficult, with 70.9% of the children having borderline or definite motor problems in the MID group and 56.5% in the BIF group. The sub-scales ball skills and balance showed relatively less motor impairment with 63.6% of the children in the MID group having borderline or definite motor problems on both sub-scales against 44.3% of the children in the BIF group. These results are in accordance with a study by Wuang *et al.* (2008), which revealed that children with MID had relatively more severe deficits with fine motor skills, comparable with the manual dexterity sub-scale of the MABC (Henderson & Sugden 1992), than with gross motor skills that are comparable with the sub-scales ball skills and balance of the MABC. This advantage of gross motor skills over fine motor skills was frequently found in other research groups (i.e. DCD and LD, Smits-Engelsman *et al.* 2003). Wuang *et al.* (2008) suggested that this is presumably caused by the fact that fine motor skills exert a greater demand on the maturity and integrity of the cortical nervous system, in particular the frontoparietal network (Davare *et al.* 2006). Within the manual dexterity subtest, the children demonstrated more deficiencies in 'speed and accuracy of each hand separately' and 'eye–hand coordination' than in 'bimanual coordination'. It seems that the children have more problems with accuracy of one hand than with items that require interlimb coordination. On the item bimanual coordination, the task is performed with the preferred hand, while the other hand is supportive. This may result in an item that is relatively less cognitively demanding than the other items of manual dexterity. The item 'speed and accuracy of each hand separately', for example, was also performed with the non-preferred hand, which appeared to be more difficult for children with ID. The findings are in agreement with those of Lahtinen *et al.* (2007) who found that in adolescents and adults with ID intelligence had a significant effect, favouring those with higher intelligence, on the test item 'pearl transfer speed', which resembled the item 'speed and accuracy of each hand separately'. The present study provides further evidence that children with ID are impaired on specific manual dexterity items.

Motor performance on the sub-scale ball skills showed motor problems in 63.6% and 44.3%, respectively, in children with MID and BIF. Unfortunately, no other comparable studies with similar samples of children could be found for comparison of these results. To adequately execute these tasks, a child must not only rely on his eye–hand coordination (Binsted *et al.* 2001), but also has to plan his movement and force of throwing, particularly in reference to the item 'aiming at a goal'. We therefore argue that, based on animal and human studies, ball skills would rely more on cortico–subcortical systems. For example, in monkeys the striatum and its nigrostriatal afferents are involved in hand–eye coordination (Matsumoto *et al.* 1999) and the striato-nigro-striatal as well as the fronto-striatal circuits are involved in the planning of movements (Haber 2003).

The performance on the sub-scale balance was quite similar to the performance on ball skills with 63.6% and 44.3%, respectively, of children with MID and BIF having borderline or definite motor problems. Examination of the individual items of the sub-scale balance showed that the item 'dynamic balance while moving slowly' did not discriminate very well with 72.7% and 82.6%, respectively, of the children with MID and BIF having no motor problems. In contrast, the items 'static balance' and 'dynamic balance while moving fast' appeared to discriminate very well between the normal population and children with MID and BIF with, respectively, 72.7% and 65.2% of the children having borderline or definite motor problems on static balance and, respectively, 69.1% and 56.5% of the children having borderline or definite motor problems on dynamic balance while moving fast. These findings are in agreement with those of Lahtinen *et al.* (2007) who found impaired static balance (measured by the stork balance test) in adolescents and adults with ID. One can only speculate about the mechanisms underlying this finding. One such mechanism might be a suboptimal functioning of the vestibulocerebellum (Pritchard & Alloway 2007).

The second part of our study, the comparison of two groups of children attending special education who differed in intellectual functioning, showed small to moderate effect sizes on motor performance as measured by the total score of the MABC as well as the three sub-scale scores. This could easily be explained by a brain imaging study by Reiss *et al.* (1996), who found that IQ is positively correlated with total cerebral volume in children and in particular with cortical grey matter in the prefrontal region of the brain. To a lesser extent, they found a positive correlation between IQ and subcortical grey matter.

The results discussed above would support the ABD concept (Kaplan *et al.* 1998; Gilger & Kaplan 2001), which is a conceptual framework for understanding developmental LDs and its high co-morbidity with other developmental disorders, like PDD-NOS, ADHD and DCD, by claiming that the aetiology of developmental disorders is due to atypical functioning of the brain, in multiple ways. First, children with ID have a higher co-morbidity rate of ADHD, with prevalence rates between 9% and 15% (Hastings *et al.* 2005), of autism spectrum disorders, with prevalence rates between 20% and 30% (Nordin & Gillberg 1996; Towbin 1997) and epilepsy with a prevalence rate of 12% in schoolchildren with MID (Hagberg *et al.* 1981). Second, the co-morbidity rate increases when the degree of intellectual impairment increases (i.e. Corbett *et al.* 1975; Beckung *et al.* 1997; Di Blasi *et al.* 2007). Third, as the present study shows, children in the MID group have a higher incidence of motor problems compared with the group of children with BIF who are adjacent to the continuum of general cognitive functioning. Fourth, magnetic resonance imaging research on mild and severe ID with unexplained aetiology concluded that people with mild or severe ID, in comparison with controls, had a higher incidence of brain anomalies, specifically in the periventricular white matter, lateral ventricular dilatation, mild corpus callosum abnormalities and subtle cerebellar abnormalities including fissure enlargement (Decobert *et al.* 2005). This would suggest that the concept of ABD, which was originally developed for understanding the high co-morbidity between LD and diverse developmental disorders like ADHD and DCD, should be expanded to include children with ID (i.e. children with an IQ score below 85).

An association was found between degree of ID and motor performance. A limitation of this study, because of the cross-sectional nature of the study, is that the results give no insight into the causality of this association. It is unclear whether better motor performance leads to higher intelligence, or vice versa. Future longitudinal studies are needed to identify the direction of the associations that were found.

In conclusion, children with ID had significantly more borderline and definite motor problems than the normative sample and there was an association between degree of ID and performance of manual dexterity, ball skills and balance skills. The study highlights the importance of improving motor skill performance in both children with borderline and mild ID, and the results support the notion that the level of motor and cognitive functioning are related in children with ID.

The results of the present study suggest that children with ID might benefit from a motor intervention that addresses their motor skills, especially those involving manual dexterity and static balance. The finding that the motor problems are most pronounced in the most intellectually challenged children supports the notion that special attention should be paid to this subgroup of children with ID.

Acknowledgements

The authors wish to thank the physical education instructors of the schools, and the children who collaborated in this study.

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Accepted 23 July 2010