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EXTENT AND NATURE OF MOTOR DIFFICULTIES BASED ON AGE, ETHNICITY, GENDER AND SOCIO-ECONOMIC STATUS IN A SELECTED GROUP OF THREE- TO FIVE-YEAR-OLD CHILDREN

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ABSTRACT

Attention to adequate motor development is important during the pre-school years, to minimise possible motor difficulties when the child grows older. The aim of this study was to establish the nature and extent of motor function problems based on socio-economic status, gender, age and ethnicity in 3- to 5-year-old children. A convenience sample of 53 participants, aged 3.0-4.11 years from five pre-schools was assessed with the Movement Assessment Battery for Children-2. A percentage of 11.32% of the group (5 girls; 1 boy) were classified with severe Developmental Coordination Disorder (DCD). These results indicate that the higher socio-economic group (22.73%), girls (15.63%), black children (18.18%) and the three-year-old group (12.50%) had the most children in the severe DCD category. The 3.0-year-old group performed significantly better ($p \leq 0.05$) than the 4.0-year-old group in aiming and catching. White children outperformed black children in fine motor skills and boys outperformed ($p \leq 0.05$) girls in aiming and catching. No statistical significant differences were found between the different socio-economic groups. These results confirm motor difficulties in 3- to 5-year-old children and age and gender differences.

Key words: Preschool children; Motor development; Developmental Coordination Disorder (DCD); Socio-economic status (SES); Screening; Gender.

INTRODUCTION

Most fundamental motor skills, broadly classified as locomotor, manipulation and stability skills, that are regarded as the building-blocks for more complex skills development (Kirk & Rhodes, 2011), develop between the ages of two and seven years (Malina, 2004). Young children who are identified with difficulties in motor development thus have a lesser ability to master fundamental motor skills (Majnemer, 1998; Chambers & Sugden, 2002). These motor difficulties include milestones in the child's development, which should have been mastered between two and seven years, for example balancing and locomotor skills.

Rosenberg *et al*., *(*2008) report an incidence of 13% motor difficulties among children under the age of three years. Giagazoglou *et al*. (2011) found that 5.4% of Greek children between the ages of four and six years experienced motor coordination problems, as tested with the Movement Assessment Battery for Children-2 (MABC-2). Nikolic and Ilic-Stosovic (2009) tested children with the Bruininks Oseretsky Test of Motor Proficiency (BOT), and reported

that 35.44% of the Grade 2 children in Belgrade, Serbia, experienced coordination problems and that 30.12% of the children in the same age group experienced balance problems. A study by Goodway *et al*. (2003) indicated that 77.4%-93.5% of the children in the south of America, with a mean age of 4.9 years, from different socio-economic classes, experienced motor difficulties prior to participating in a nine-week intervention programme, as tested with the Test of Gross Motor Development (TGMD).

Developmental Coordination Disorder (DCD), is defined by the *Diagnostic and Statistical Manual* (DSM-5) of the *American Psychological Association* (APA, 2013), as a noticeable problem in the learning and execution of coordinated motor skills, which interfere with activities of daily living and academic performance of where the onset are already seen in the early developing years. The condition of DCD is not attributed to intellectual disability, visual impairment or any neurological condition affecting movement. According to the APA (2013), the incidence of DCD among school-going children between the ages of five and 11 years worldwide is estimated to be between 5 and 6%, while Gwynne and Blick (2004) report an incidence of 4.2% among five-year-olds tested with the Bruininks Oseretsky Test of Motor Profiency-2 (BOT-2). However, literature still debates the incidence of DCD among school-going children with estimates that vary between 1.8% (Lingam *et al*., 2009) and 6% (Missiuna, 2008; Asonitou *et al*., 2012). The boy-girl ratio of children diagnosed with DCD as noted in the DSM-5, vary between 2:1 and 7:1 (APA, 2013).

Researchers report that socio-economic and cultural differences also play a role in children's motor development (Wright *et al*., 1994; Hadders-Algra, 2000; Uys & Pienaar, 2010). Studies found that children from impoverished socio-economic circumstances usually receive quantitatively less stimulation than children do from better social backgrounds and that this contributes to poorer development (Hadders-Algra, 2000; Goodway & Branta, 2003). Children who are exposed to these circumstances are also subjected to more risk factors that contribute to poorer development. The risk factors that are reported include low birth weight, prenatal exposure to drugs or alcohol, scant or limited prenatal care (Kazdin, 1995). In this regard, Herbst and Huysamen (2000) indicate that children from more fortunate socio-economic circumstances have better fine motor skills, while those from poorer economic circumstances showed better gross motor skills due to the fact that they play outdoors more often and are less exposed to classroom activities. Uys and Pienaar (2010) also found that children with a mean age of 77 months from lower socio-economic circumstances generally performed poorer in gross and fine motor skills than children from higher socio-economic circumstances.

Gender differences with regard to motor development have also been reported. According to several researchers, boys perform better in activities that require strength and speed, like running, jumping and throwing, whereas girls perform better in fine motor activities like figure tracing, balancing activities and activities that require rhythm, such as hopping and skipping (Lefebvre & Reid, 1998; Malina, 2004; Livesey, *et al*., 2006; Shala & Bahtiri, 2011). Pienaar and Kemp (2014) report that overall motor proficiency of boys is better than that of girls at the age of 6.8 years as tested with the BOT-2. These researchers also found that boys performed better with upper limb coordination and strength skills, while girls performed better with manual dexterity and bilateral coordination skills, although no gender differences were found for fine motor integration, fine motor accuracy, balance and dexterity

(Pienaar & Kemp, 2014). There are, however, also studies that reported no gender differences between the gross motor skills of boys and girls (Pollatou *et al*., 2005; Kirk & Rhodes, 2011).

A few studies confirm that ethnicity plays a role in children's motor development (Capute *et al*., 1985; Pienaar & Kemp, 2014). Capute *et al*. (1985) reported that when children were monitored from birth to the age of two years for reaching various milestones, black children reached these milestones sooner than white children. However, Martinek *et al*. (1978) found that the motor development of eight-year-old black children was poorer than that of white children, but that the differences lessened as they grew older. These researchers tested the children with the "Schilling Body Coordination Test" and compared the motor status of children of different ethnical groups and ages. Pienaar and Kemp (2014) further reported that white children in Grade 1 performed significantly better in six of the eight sub-tests, namely fine motor precision, fine motor integration, hand dexterity, bilateral coordination, upper limb coordination and strength subtests of the shortened version of the BOT-2. In turn, the black children performed better in the sub-tests for balance, running speed and dexterity. These researchers, however, ascribed these differences to the mediating role of socio-economic status rather than to ethnicity (Pienaar & Kemp, 2014).

From the above-mentioned studies, it appears that gender, ethnicity and the socio-economic environment, play a role in the nature and extent of motor difficulties. The few studies that report an incidence of motor difficulties among young children (Goodway *et al*. 2003; Rosenberg *et al*., 2008), do indicate motor difficulties among children between the ages of three and five years. There is, however, limited literature relating to the nature and extent of DCD among three- to five-year-old South African pre-school children and also taking into account the role that age, ethnicity, gender and socio-economic status play in such difficulties.

AIM OF THE STUDY

The aim of the study was to determine the extent and nature of motor difficulties among three- to five-year-old children, based on their age, ethnicity, gender and socio-economic status.

METHOD OF RESEARCH

Study population

The study population was selected from 5 different pre-primary schools in the Potchefstroom area of the North-West Province, South Africa, based on availability to participate in the study, taking into account their age, ethnicity, gender and socio-economic status (SES). Three of the schools were situated in less affluent areas of Potchefstroom, while 2 of the schools were situated in areas that are more affluent. Fifty-three children, between the ages of 3 and 5 years, were identified. The children were all assessed with the MABC-2 to determine their coordination status. The children were then divided into 2 age groups according to their chronological ages, namely 3.0 to 3.11 years (n=24) and 4.0 to 4.11 years (n=29). Twenty-one boys (n=21) and 32 girls (n=32) were included representing 2 ethnic groups, namely white (n=20) and black (n=33).

The group was also divided into 2 SES groups, namely low (11 white, 20 black) and high (11 white, 11 black). This division was based on information obtained by means of a demographic questionnaire that the parents/legal guardians had to complete where income categories were given and they had to indicate the combined income level in which they fell. The low socio-economic class was identified when the parent or legal guardian indicated that a government grant or a combined income of R5 500 per month was received. The middle income socio-economic group was identified when the parents or legal guardians had a combined income of between R5 500 to R35 000, while parents or legal guardians were placed in a high socio-economic income group when a combined income of higher than R35 00 per month was indicated (Stats SA, 2010). The middle and higher socio-economic income groups were combined into a higher socio-economic group because of the small numbers of participants.

Inclusion criteria were that the parents or legal guardians had to speak Afrikaans, English or Tswana. Children had to be between the ages of 3.0 to 4.11 years to participate in the study. Criteria that excluded children from participation in the study were if definite mental retardation, autism or any other identified neuro-motor difficulty or dysfunction were suspected.

Measuring instrument

Movement Assessment Battery for Children-2 (MABC-2)

The MABC-2 is a standardised measuring instrument, which was developed and adapted from the MABC by Henderson *et al*. (2007). Children participating in the research had to perform a number of motor tests in a specific manner to determine motor difficulties objectively. The MABC-2 is designed to identify children between the ages of 3.0 years to 16.11 years who are thought to have motor coordination difficulties. Age group 1 (3 to 6 years) of the MABC-2 was used to identify 3- to 5-year-old children with motor difficulties.

The MABC-2 has 8 sub-items divided into 3 main sections, namely fine motor, aiming and catching and balance. Each raw score is reflected in a point score as described in the MABC-2 manual. The number of points is converted to a standard score that is then used to determine a percentile score. A higher standard score obtained by the child indicates better performance and will show a higher percentile score. The cut-off points of the MABC-2 are determined according to standard scores that are interpreted as follows (total and sub-divisions): green (no DCD-status, $\geq 15^{th}$ percentile, total score of 67 and higher, no motor difficulties); yellow (risk of DCD, between the 5^{th} and 15^{th} percentile and standard scores between 57 to 67, at risk for coordination disorder); and red (severe DCD, $\leq 5^{th}$ percentile and standard score of 56 or less). The MABC-2 reflects good reliability for the sub-items separately (r= 0.73 to 0.84) and for the total test score (r= 0.80) (Henderson *et al*., 2007). A qualified Kinderkineticist conducted the assessment at the different pre-schools.

Ethical clearance

Ethical approval for the study was obtained from the Ethics Committee of the North-West University, Potchefstroom campus (NWU-00066-12-A1), as well as the Department of Basic Education of the North West Province. A meeting was held with the various school

principals, during which the purpose and protocol of the study were explained. Informed consent was also obtained from all parents/legal guardians prior to the inclusion of the children in this study.

Statistical analysis

The "Statistica for Windows 2012" StatSoft-computer programme package was utilised (StatSoft, 2013) to analyse the data. Data was firstly analysed for descriptive purposes by means, standard deviations (SD) and minimum and maximum values. Frequency tables were used to analyse the DCD status of the group, where the percentages of children that were categorised in each group were indicated. Differences between means relating to the groupings within age, ethnicity, gender and socio-economic status were calculated by using independent t-testing, where $p \leq 0.05$ was accepted as significant. Effect sizes (ES) were calculated to determine the practical significance of the results by dividing the difference between the means of the 2 test occasions by the larger standard deviation (SD). For the interpretations of practical significance, the following guidelines were used: $d \geq 0.2$ indicates a small effect; $d \geq 0.5$ a medium effect; and $d \geq 0.8$ a large effect (Cohan, 1988). Differences were regarded as practically significant if the ES indicated a medium and/or large effect.

RESULTS

For comparison purposes, the 53 subjects that were part of the study were divided based on age, ethnicity, gender and socio-economic status (SES) as reflected in Table 1.

TABLE 1. **NUMBER OF SUBJECTS ACCORDING TO AGE, ETHNICITY, GENDER AND SOCIO-ECONOMIC CLASS GROUPS**

	Age (n)		**Ethnicity** (n)		**Gender** (n)		**SES** (n)	
	3-4 yrs	4-5 yrs	White	Black	Boys	Girls	Lower	Higher
	24	29	20	33	21	32	31	22
Total (N)	53		53		53		53	

N/n= Number of subjects yrs= years SES= Socio-Economic Status

Table 2 provides the results on the distribution of the subjects in each of the different DCD categories. Category 1 (above the 15th percentile) indicated no possibility of DCD in 60.37% of the subjects. Category 2 indicated that DCD of a moderate nature (5 to 15th percentile) was identified in 28.30% of the group, while 6 of the subjects (11.32%) were categorised in the third group (0 to 5th percentile), indicating definite or severe DCD among them.

TABLE 2. **DISTRIBUTION OF DCD SUBJECTS IN GROUP**

DCD category	**Number (N)**	**Cumulative (n)**	**Percentage(%)**
1: No DCD	32	32	60.37
2: Moderate DCD	15	47	28.30
3: Severe DCD	6	53	11.32

N/n= Number of subjects

Table 3 reflects the frequency distribution according to the group in which the subject was placed with regard to his/her DCD status in each age, ethnic, gender and socio-economic group. This analysis indicates that with regard to percentages, the high SES group (n=5; 22.73%) had the highest percentage of children in the severe DCD group, as well as the girls (n=5; 15.63%), black children (n=6; 18.18%), and the 3-year-old group (n=3; 12.50%). The largest percentage of the subjects (52 to 75%) in the different age, ethnic, gender and socio-economic groups were diagnosed with no possibility of DCD.

TABLE 3. **DISTRIBUTION IN DCD CATEGORIES ACCORDING TO AGE, ETHNICITY, GENDER AND SOCIO-ECONOMIC STATUS**

Groups		No DCD	Moderate DCD	Severe DCD	Total Group	Moderate + Severe DCD
3.0-3.11yrs	(n)	17	4	3	24	7
	%	70.83	16.67	12.50	100	29.17
4.0-4.11 yrs	(n)	15	11	3	29	14
	%	51.72	37.93	10.34	100	48.27
White	(n)	15	5	0	20	5
	%	75.00	25.00	0.00	100	25.00
Black	(n)	17	10	6	33	16
	%	51.52	30.30	18.18	100	48.48
Boys	(n)	15	5	1	21	6
	%	71.43	23.81	4.76	100	28.57
Girls	(n)	17	10	5	32	15
	%	53.51	31.25	15.63	100	46.88
Low	(n)	19	11	1	31	12
	%	61.29	35.48	3.23	100	38.71
High	(n)	13	4	5	22	9
	%	59.09	18.18	22.73	100	40.91

n= number of participants

In addition, independent t-testing was applied to determine the mean values, which the subjects obtained in the MABC-2 and the 3 sub-scales according to age, as well to determine the significance of differences between means (Table 4 to Table 7).

The 3.0 to 3.11 age group performed significantly better than the 4.0 to 4.11 age group in the aiming and catching standard score (22.75±4.46 vs. 19.93±4.14), aiming and catching percentile (66.64±26.57 vs. 52.63±24.78), and the MABC-2 percentile (41.87±26.94 vs. 26.38±20.06) (Table 4). No statistically significant differences occurred between the age groups in the fine motor standard score, fine motor percentile, balance standard score, balance percentile and the MABC-2 standard score, therefore, the practical significant differences that were found are not considered important, although it could indicate tendencies.

TABLE 4. **DIFFERENCES BETWEEN AGE GROUPS: MABC-2 AND SUBSCALES** (N=53)

Variables	**3.0-3.11 yrs** (n=24) Mean±SD	**4.0-4.11 yrs** (n=29) Mean±SD	**Significance of differences** t	df	p-value	d
Fine motor SS	17.75±5.52	16.03±5.85	1.08	51	0.281	**0.30***
Fine motor P	10.10±9.21	8.10±10.52	0.72	51	0.469	**0.20***
Aim-catch SS	22.75±4.46	19.93±4.14	2.37	51	**0.021**#	**0.66****
Aim-catch P	66.64±26.57	52.63±24.78	1.98	51	**0.052**#	**0.55****
Balance SS	31.91±6.48	30.51±6.87	0.75	51	0.452	**0.21***
Balance P	60.66±32.13	54.72±34.26	0.64	51	0.521	0.18
MABC-2 SS	72.87±13.43	66.82±12.42	1.70	51	0.095	**0.48***
MABC-2 P	41.87±26.94	26.38±20.06	2.39	51	**0.020**#	**0.67****

N= number of subjects; SS= Standard Score; P= Percentile; SD= Standard Deviation df= degrees of freedom; #p=≤0.05; d-value≥0.2*; d-value≥0.5**

Table 5 displays the differences between the 2 ethnic groups. The fine motor standard score (p=0.005; d= 0.80) and the fine motor percentile (p=0.006; d= 0.80) of the black and white children indicate statistically and practically significant differences, where the white group (19.55±4.37 and 13.70±12.33), performed significantly better than the black group (15.15±5.85 and 6.16±6.87) respectively. No statistical significant differences were found in the aiming and catching total, balance total and MABC-2 totals. The practical significant differences found are considered less important, but they could serve as indicator of tendencies towards significance.

TABLE 5. **DIFFERENCES BETWEEN ETHNIC GROUPS: MABC-2 AND SUBSCALES** (N=53)

Variables	**White (n=20)** Mean±SD	**Black (n=33)** Mean±SD	**Significance of differences** t	df	p-value	d
Fine motor SS	19.55±4.37	15.15±5.85	-2.89	51	0.005#	0.80***
Fine motor P	13.70±12.33	6.16±6.87	-2.86	51	0.006#	0.80***
Aim-catch SS	21.75±3.65	20.87±4.94	-0.68	51	0.498	0.19*
Aim-catch P	60.17±23.97	58.25±27.97	-0.25	51	0.799	0.07
Balance SS	31.35±4.69	31.03±7.69	-0.04	51	0.867	0.01
Balance P	57.65±30.88	57.26±34.89	0.95	51	0.968	0.26*
MABC-2 SS	72.95±8.82	67.51±14.90	-1.47	51	0.145	0.41**
MABC-2 P	38.00±21.29	30.60±26.12	-0.16	51	0.290	0.04

N= number of subjects; SS= Standard Score; P= Percentile; SD= Standard Deviation df= degrees of freedom; #p=≤0.05; d-value≥0.2*; d-value≥0.5**

Table 6 presents the results of a comparison between boys and girls. Boys and girls only differed significantly in 1 test item namely the aiming and catching standard score (p=0.016; d= 0.69), where boys (23.00±4.77) outperformed the girls (20.03±3.92). No statistically significant gender differences were found in the fine motor percentile, aiming and catching percentile, the balance standard score and the MABC-2 standard score. Once again, the practical significant differences that are indicated in the table are not convincing but may indicate a tendency towards significance.

TABLE 6. **DIFFERENCES BETWEEN GENDER GROUPS: MABC-2 AND SUBSCALES** (N=53)

Variables	**Boys** (n=21) Mean±SD	**Girls** (n=32) Mean±SD	**Significance of differences** t	df	p-value	d
Fine motor SS	17.00±4.50	16.68±6.46	-0.19	51	0.847	0.05
Fine motor P	7.09±6.16	10.26±11.66	1.14	51	0.258	**0.32***
Aim-catch SS	23.00±4.77	20.03±3.92	-2.47	51	**0.016**$^{\#}$	**0.69****
Aim-catch P	66.66±26.24	53.93±25.51	-1.75	51	0.085	**0.49***
Balance SS	32.19±5.61	30.46±7.29	-0.91	51	0.363	0.25
Balance P	60.80±33.36	55.18±33.33	-0.60	51	0.551	0.17
MABC-2 SS	72.19±10.92	67.84±14.28	-1.18	51	0.210	**0.33***
MABC-2 P	36.19±24.23	31.56±24.82	-0.66	51	0.506	0.18

N= number of subjects; SS= Standard Score; P= Percentile; SD= Standard Deviation df= degrees of freedom; #p=≤0.05; d-value≥0.2*; d-value≥0.5**

TABLE 7. **DIFFERENCES BETWEEN SOCIO-ECONOMIC STATUS GROUPS: MABC-2 AND SUBSCALES** (N=53)

Variables	**Lower** (n=31) Mean±SD	**Higher** (n=22) Mean±SD	**Significance of differences** t	df	p-value	d
Fine motor SS	17.96±5.05	15.18±6.30	-1.78	51	0.080	0.50**
Fine motor P	9.77±10.41	7.93±9.28	-0.66	51	0.510	0.18
Aim-catch SS	21.87±4.63	20.27±4.17	-1.28	51	0.203	0.36*
Aim-catch P	63.59±26.05	52.47±25.88	-1.53	51	0.130	0.43*
Balance SS	32.00±5.50	29.95±8.02	-1.10	51	0.275	0.31*
Balance P	59.31±29.82	54.72±37.89	-0.49	51	0.623	0.14
MABC-2 SS	71.83±11.41	66.36±14.90	-1.51	51	0.135	0.42*
MABC-2 P	36.64±25.49	28.82±22.71	-1.15	51	0.255	0.32*

N= number of subjects; SS= Standard Score; P= Percentile; SD= Standard Deviation df= degrees of freedom; #p=≤0.05; d-value≥0.2*; d-value≥0.5**

Table 7 provides the analysis of the results for SES with regard to the MABC-2 and the 3 subscales. No statistical significant differences were found between the lower and higher

socio-economic groups, although the fine motor standard score of the 2 groups reflected borderline significant differences (p=0.080; d= 0.50). This indicated that the lower socio-economic group (17.96±5.05) had a tendency towards better performance than the higher socio-economic group (15.18±6.30) in the fine motor total standard score. The standard deviation scores of the groups indicated higher variation in the higher socio-economic group especially in balancing skills which could have influenced their results. The practical significant differences that were found may, therefor, only indicate tendencies, as only a small group of participants were part of the group.

DISCUSSION

The aim of the study was to determine the extent and nature of motor difficulties based on age, ethnicity, gender and SES in children aged three to five years.

A percentage of 11.32% of the total group was classified with severe DCD, and consisted of mainly girls. These results differ from most of the literature relating to the prevalence of DCD between the two genders. From the literature it appears that more boys than girls are diagnosed with coordination problems (with a 2-6:1 ratio) (Pienaar & Lennox, 2006; Asonitou *et al*., 2012). The boy/girl ratio of children diagnosed with DCD also varies from 2:1 and 7:1 according to the DSM-5 (APA, 2013). It is, however, true that mostly clinical studies were reported in this regard, whilst this particular study is population-based, where the ratios are often closer to each other. All six of the children that were classified in the severe DCD group were black, of which five girls and one boy, and five of the children were from the higher socio-economic group.

Cultural differences, where the education of boys is often regarded as more important than that of girls, could perhaps be regarded as a possible explanation. In this regard, Malina (2004) reports that cultural conditioning for gender specific roles starts at a young age; that boys and girls are brought up differently; and that at the age of three discernible differences start to become noticeable between the genders. Walter (2011) also reported that girls are expected to perform household tasks from a young age, while boys are encouraged, by their parents and peer group, to participate in more challenging physical activities, which can contribute to their more advanced motor skills. South African children who grow up in high socio-economic circumstances are often encouraged to play indoors for safety reasons (Pienaar, 2009). This includes engaging in technological games rather than in physical activity (Walter, 2011). In addition, they could have been placed in day-care facilities while their parents have to work. Opportunities for physical activities that contribute to gross motor development may have been restricted in this way, which could have contributed to the higher DCD classification in this group.

The literature reported that the incidence of DCD among school-going children between the ages of five and 11 years is estimated to be 5 to 6% on a worldwide scale (APA, 2013). Cairney *et al*. (2005) reported an incidence of 5 to 9% among children aged nine to 14 years diagnosed with DCD, while Gwynne and Blick (2004) reported a DCD incidence of 4.2% among five-year-olds in Australia. The present study is representative of different ethnic groups and cultures, genders and socio-economic status, which may all be contributory factors to the higher incidence that was found. This also confirms the results of the study of

Uys and Pienaar (2010). South Africa is regarded as a low to middle income developing country where there are many challenges facing the motor development of children (Le Roux, 2013).

In the present study, none of the white children were classified in the severe DCD group, while 18.18% black children were. A study by Pienaar and Kemp (2014) also reported that more six-year-old white children were categorised in the average motor proficiency category (69.27 vs. 38.98%) than black children, where more black children (58.73%) were classified in the below average motor proficiency category. 22.73% of the children in the higher socio-economic group compared to 3.23% in the low socio-economic group were classified in the severe DCD category. Although speculative, a possible reason might be that the parents of white children are more aware of the importance of their child's motor development and are subsequently more involved in their development and spend more time playing with them while cultural influences have a bigger role to play in black families.

Booth *et al*. (1999) reported that fundamental movement skills development are more related to socio-economic circumstances in girls than in boys. In the study of Booth *et al*. (1999), socio-economic conditions played a role in the motor development of girls aged four to 10 years, while the effect of socio-economic conditions were not as prevalent among boys (Booth *et al*., 1999). Uys and Pienaar (2010) also reported that children between the ages of four and 71 months in the low socio-economic group generally performed poorer than the children from a higher socio-economic group did when the two groups were analysed separately as tested with the "Peabody Developmental Motor Scales-2". In an earlier study on a randomly selected group of children between the ages of 10 and 12 years in the North-West Province of South Africa, an incidence of 36.4% severe DCD was found (Pienaar, 2004). Recommendations in this study suggested the norms in the test battery (MABC 1st version) needed to be adjusted in order to make the test battery more valid for the developmental challenges that children face in developing countries.

These current results indicate that there are differences between the various ages and genders regarding the nature of motor difficulties. The results show that 3.0- to 3.11-year-olds performed significantly better than 4.0- to 4.11-year-olds in aiming and catching, as well as in the MABC-2 percentile scores achieved. These results differ from Gallahue and Ozmun's age appropriate developmental phases, which indicate that children's development ought to improve progressively with increasing age (Gallahue & Ozmun, 2006; Pienaar, 2012).

Large variations, as can be seen in the standard deviations that are reported, were, however, found in the motor development of both the younger and older age groups, which is characteristic in children of this age group (Malina, 2004; Gallahue & Ozmun, 2006), and which might have contributed to the differences that were found. In this regard, Malina (2004) reported that the sequence of development in young children is similar, but that the attainment of motor milestones indicates large inter-individual age-associated variation. The early developmental phase is characterised by variation in motor development, which does not necessarily reflect a delay (Malina, 2004). The small number of children who were compared could also have influenced the results, while the children's performance on the day of testing might also have been influenced by how they felt (Malina, 2004). Another reason might be that parents could become less involved in their children's development as their

children grow older.

Timmons *et al*. (2007) reported that the level of physical activity of pre-schoolers is comparable to the amount of time their parents spend with their children doing physical activities. The same researchers also suggested that the more physically active children are, the better their motor development become. It would thus appear that the more involved parents are with young children's play and development (games, cycling), the better the child's motor development will be. However, Livesey *et al*. (2006) found that five-year-old Australian children performed poorer than four-year-olds in ball skill tests, although the four-year-old group was not representative of all the different areas (suburban and urban). Livesey *et al*. (2006) furthermore found that the older children in the three age groups (three- to five years) performed better, as tested with the MABC-2 test, in hand dexterity and balance skills as they grew older.

Minor differences were found between fine motor skills in white and black children. A few researchers also confirmed that ethnic origin played a role in the motor status of children (Martinek *et al*., 1978; Capute *et al*., 1985). Martinek *et al*. (1978) found that eight-year-old black children's motor development lagged behind that of white children, but that the differences became less with age. On the other hand, Capute *et al*. (1985) monitored children as they reached various milestones and found that black children reached their early developmental milestones (roll, sit, stand and walk), sooner than white children. Pienaar and Kemp (2014) also found that white children in Grade 1, in the North-West Province of South Africa, performed better with fine motor precision and fine motor integration skills than black children. These researchers, however, ascribed the differences to socio-economic rather than to ethnic differences.

Statistically significant differences were found between the aiming and catching skills of the boys and girls in this study. These results concur with those of other researchers, which indicate that boys performed better with manipulation skills (Goodway *et al*., 2003; Livesey *et al*., 2006; Shala & Bahtiri, 2011; Pienaar & Kemp, 2014). Livesey *et al*. (2006) report that three- to five-year-old boys in Australia performed significantly better in the ball-rolling skill, as tested with the MABC-2. Pienaar and Kemp (2014) found that the overall motor proficiency level of boys was better than that of girls at the age of 6.8 years, tested with the BOT-2. The boys also performed better in upper limb coordination and strength skills, whereas girls performed better with hand dexterity and bilateral coordination skills. However, they did not report any gender differences relating to fine motor integration, fine motor accuracy, balance, running speed and dexterity.

The study of Livesey *et al*. (2007) reported no gender differences in gross and fine motor skills. Four- and five-year-olds boys and girls did not differ on placement of coins, catching and throwing of beanbags, heel-toe walking and rope-skipping skills. Goodway *et al*. (2003) also reported no gender related differences among pre-school children in locomotor skills. Pollatou *et al*. (2005) found no gender differences in five of the six skills tests of the TGMD-2 among pre-schoolers, with the exception that girls did better in the sliding skill than boys. These studies support the results of the present study where no differences were found between the genders in balance and fine motor skills.

Wright *et al*. (1994) reported that socio-economic and cultural differences did play a role in the motor development of children. However, no differences were found between socio-economic groups in their study. This differs from other research that indicated that children from lower socio-economic classes performed poorer than children from higher socio-economic classes (Uys & Pienaar, 2012). Uys and Pienaar (2012) found that children from a higher socio-economic class performed better in fine motor skills. The results of the present study indicate that children from the lower socio-economic group obtained higher, although not significantly higher mean values ($p \geq 0.05$) for balancing and object manipulation skills. A possible reason for these slight differences could be that the effect of the different socio-economic circumstances might not be so significant at a young age. However, the findings of Malina (2004) indicated that the influence of social variables decreases with an increase in age in throwing skills. The lower socio-economic group of the present study constituted mainly black children (20 out of 31). Capute *et al*. (1985) indicated that from birth to the age of two years, black children reach their gross motor milestones (sit and crawl) faster than white children do.

The findings of this study must be considered against the background of the limitations that were present and, therefore, generalisation of the findings has to be done with caution. Since this study focused on children of a very young age, their participation might have been influenced by numerous factors, such as the unfamiliarity of the situation, which might have influenced their motivation to do their best. The results were furthermore obtained from a small number of children and because of the young age of the group, considerable inter-variation in development was noted.

Malina (2004) indicated that the early developmental phase is characterised by considerable variation in motor development that does not necessarily reflect delays. Therefore, it is recommended that similar research be undertaken on a larger number of children of the same age group to confirm the results and the tendencies that were reported based on practical significance. Socio-economic comparisons were based on broad income levels only and subsequently, did not take other indicators, such as education of the parents into account, which could also have influenced the results that were obtained.

It is recommended that similar research on young children should consider factors, such as the education of the parents and rearing influences. The recommendations of experts, namely that children should only be diagnosed with DCD after the age of five years (although the MABC-2 can, in fact, identify DCD from the age of three years), as well as recommendations regarding the interpretation of the results of this study, need to be taken into account. This is especially important for further research relating to the prevention and early identification of the incidence of DCD.

PRACTICAL IMPLICATIONS

Early screenings for motor difficulties that can be indicative of possible DCD are important. These results are important for educators, day care mothers and professionals dealing with the motor development of children such as occupational therapists and Kinderkineticists, to address the problems as early as possible. Ignorance and lack of recognition of motor functioning and motor learning difficulties can be addressed by workshops that are presented

to parents of young children, enabling them to recognise when their children require help and to make them aware of the importance of obtaining professional support for their children as soon as possible.

CONCLUSION

This study established definite motor difficulties among a noteworthy percentage of children between the ages of three- and five years in different age, ethnic, gender and socio-economic groups. This emphasises the importance of participation in age-appropriate motor development programmes, which can serve a preventative purpose for motor difficulties that might develop early. The fact that three- to five-year-olds experienced motor difficulties further underlines the importance of identifying these children early with subsequent timely intervention or support to prevent the difficulties from becoming ingrained problems that have long-term implications for their quality of life. Motor problems are modifiable risk factors in the development of young children that can be treated successfully once identified.

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