ASSESSMENT OF FUNDAMENTAL MOTOR SKILLS PROFICIENCY AMONG CHILDREN WITH AUTISM SPECTRUM DISORDER AT PERSATUAN KANAK-KANAK ISTIMEWA AMPANG

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The Fundamental Motor Skills or FMS play the important role for the human development to improve stability in balance, locomotor in jump and hop with objective control such as catch, and throw skill. FMS are building blocks for more complex and specialised skill that involve different body parts such as feet, legs, trunk, arms and hands. In addition, FMS can be categorised into sub-group of skills, including objective control skill and locomotor skill. Therefore, FMS also have relationship with physical activity for children. The greater FMS in early children leads to higher levels of physical activity, physical fitness and perceived motor competence. The purpose of this study is to evaluate the level of FMS among children with autism spectrum disorder (ASD) and to compare the level of FMS between genders among them. This study utilised a non-experimental causal-comparative design. A total of 20 children (n=20), males (10) females (10), aged between 14 to 16 years old participated in the study. The children underwent fourteen (14) sub tests using The Bruiniks-Oseretsky Test of Motor Proficiency, Second Edition (BOT-2) assessment. After the warming-up session, each child was given trials for each test depending on the test procedure. At the end of the test, cooling down session for seven minutes had been conducted. The data was analysed using independent t-test. The results showed there were significant difference found in Jumping Up and Clapping Hand Test, with $t(18) = 2.72$, $p<0.05$), and Standing Broad Jump Test with $t(18) = 2.87$, $p<0.05$. The mean and standard deviation show that males outperformed females in ten tests while females only outperformed males in four tests. In conclusion, the level of FMS and comparison between genders among children with ASD do not show much significant difference in this study. The findings of the study are very essential when designing and conducting physical activities for children with ASD. The findings can also be used as the benchmark for future studies to explore further regarding FMS among other disabilities as well.

Keywords: The Bruiniks-Oseretsky Test of Motor Proficiency, Second Edition (BOT-2), fundamental motor skill proficiency, autism spectrum disorders

INTRODUCTION

Fundamental motor skill (FMS) is the skill that involve different body parts such as feet, legs, trunk, arms and hands for the development of more complex and specialised skill. In addition, FMS can be categorised into sub-skills, including objective control skill and locomotor skill. Objective control skills involve the control of implements or objects such as catching, bouncing, throwing, dribbling, striking with either the hand or foot while locomotor skill involves transportation of the body in any direction from one point to another, for example walking, running, jumping and so on. Therefore, FMS play the important role for the human development to improve stability in balancing, locomotor in jumping and hopping with objective control skills such as catching, and throwing skill (Van Capelle et al., 2017). Hence, running, catching, jumping, throwing and others is the ability to perform FMS. Basically, FMS development takes place at the early stage of physical development during early childhood. FMS is divided into two factors such as attitude or environment and genetic factor which includes development of central nervous system and neurological (Pasco, 2018). The learning of FMS is aimed at obtaining information, using information, learning something and doing something. Motor control is a study on posture and human movement as well as mechanisms that control both posture and movement. Therefore, movement control is achieved through the interaction of all types of motor skills that are generated by biological systems (Pasco, 2018).

According to Bo et al. (2016), children with autism spectrum disorder (ASD) is a neurological and development disorder that begins in childhood. Children with ASD experience a delay in motor development such as moving the hand, fingers, toes, lips, and tongue. It is because the child's FMS will be disturbed while drawing, typing, speaking, and even playing (Bo et al. 2016). Therefore, it shows that FMS is very important in daily life without which, one might not be able to involve oneself in drawing, typing, speaking and playing. This problem come from problem in social communication, social interaction, and sensory, stereotyped and repetitive behaviour among children with ASD (Pasco, 2018). Other study found that, the ASD are commonly in boys than in girls and the reason is still unknown (Will et al., 2018).

Children with ASD may face mental condition. They are characterised by disturbances of behaviour, social interaction, and communication such as unusual eye contact, rituals and sensory problem and performing relationship with other people (Jimenez et al., 2015). In other words, children with ASD may have trouble to understand what the other people think and feel due to difficulty in expressing the words, facial expression and touch. These represent core deficit in ASD. Limited data suggest that children with ASD experience significant FMS delays compared with their neurotypical (NT) peers (Liu & Breslin, 2013). For example, Pan et al. (2009) used a process-oriented assessment of FMS, the Test of Gross Motor Development-Second Edition (TGMD-2; Ulrich, 2000), to compare FMS performance scores of the three samples of children (aged 6-10 years): 28 children with ASD, 29 with attention-deficit/hyperactivity disorder (ADHD), and 34 NT children. Results showed that both locomotor and object-control subtest TGMD-2 scores were significantly lower in children with ASD compared to children with ADHD or NT controls. Further highlight on the significant FMS delays in children with ASD includes the following: Staples and Reid (2010) compared a sample of 25 children with ASD (aged 9-12 years) with three samples of NT children, matched on chronological age, movement skills, and mental-age. Results

revealed that children with ASD had significantly lower TGMD-2 scores when compared to age-matched and mental-age-matched NT counterparts, but not when compared to the movement-skill-matched sample (Healy et al., 2021). Substantial differences in FMS performance between children with ASD and NT children were also found in studies using the Movement Assessment Battery for Children-2 (MABC-2; Henderson et al., 2007). For example, Liu and Breslin (2013) compared the performance of MABC-2 tasks between a sample of 30 children with ASD (aged 3-16 years) and a sample of 30 age-matched NT children. The sample with ASD had significantly lower MABC-2 scores compared to the NT sample. In another study, Whyatt and Craig (2012) compared the performance of MABC-2 tasks between a sample of 18 children with ASD (aged 7-10 years) and two groups age-matched samples of NT children: a receptive-vocabulary-matched sample and a nonverbal-IQ-matched sample. The overall standardised MABC-2 score was significantly lower in the ASD group compared to the NT groups. Interestingly, a sub-analysis revealed that performance discrepancies were the most significant for catching a ball and static balance, leading the researchers to conclude that motor-skill deficits in children with ASD may be more apparent in activities demanding complex, interceptive actions or core balance ability (Whyatt & Craig, 2012).

According to this issue, Individual with ASD show lower motor skill development differently compared to able person and this led to poor level of physical activity. The development of fine motor is greatly dependent on brain development, balance and enhancement of child eye and hand coordination. However, children with disabilities are different from middle-aged or typical children in mental characteristics, sensory potential, nerve and muscular or physical characteristics, social or emotional behaviour, communication capabilities and various disadvantages. Difficulties with physical activity have been well documented among students with ASD. All of this represent the children with ASD have motor dysfunctions and not only experience motor coordination deficit but also delays in various aspects of motor development at an early age. However, the motor skill level among children with ASD in Persatuan Kanak-Kanak Istimewa Ampang currently are not known. Previous study reported by Bishop and Pangelinan (2018) state that children with ASD had lower level of fundamental motor skills. Therefore, if the children with ASD did not learn and practice skill of motor skill, they are at risk to developing health condition such as cardiovascular disease. Past studies show that children with ASD had deficit on fine and gross motor skill in age 14 and 24 months (MacDonald et al., 2013). Due to inconsistency result by the previous study, the current study is conducted with the objective to measure the level of FMS among children with ASD and to compare the level of FMS among both genders.

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METHODOLOGY

Research Design

The non-experimental causal-comparative design was applied in the study with the objective to identify the level of FMS among different gender of children with ASD.

Sample

A total of 20 (n=20) children with ASD participated in the study. There were equal number of males (n=10) and females (n=10) aged between 14 to 16 years old who are institutionalised at Persatuan Kanak-kanak Istimewa Ampang, Kuala Lumpur. Diagnosing children with ASD is difficult since there is no medical test to diagnose the disorder. However, medical doctor diagnoses a child based on their developmental history and behaviour. Inclusion criteria of the study are a) children with mild and moderate ASD; b) aged between 14 to 16 years old; c) they are free from any injury and illness; and d) they are willing to participate in the study (consent had been given by their parents/guardians/caregivers). Children with other disability/condition were excluded from the study.

Instrumentation

Motor skill proficiency was measured by the Bruininks-Oseretsky test of motor proficiency (BOT-2) by Cools et al. (2009). According to Cools et al. (2009), BOT-2 is the revision test of the Bruinks-Oseretsky test of motor proficiency (BOTMP). This test also was designed to measure fine and gross motor skills of children aged 4 to 21 years old. The BOT-2 provides a broad and general view on the movement skill development status of a child, to represent significant aspects of motor behaviour, to emphasise motor activity, to provide the opportunity to discriminate between a broad range of motor abilities and to fall within the possibilities of mild and moderate mentally retarded children by Cools et al. (2009). Past study discover that the BOTMP is the valid instrument to assess motor function of fine and gross motor skill for individuals aged 4 to 21 years old and the test-retest reliability of the BOT-2 test was reported to be 0.87 (Najafabadi et al., 2018).

For the study, the BOT-2 test consists of 8 subtests and divided into two that are fine motor skills and gross motor skills. Gross motor skills tests consist of running speed and agility, balance (standing on preferred leg on floor and standing on preferred leg on balance beam), coordination (jumping in place-leg and arm on opposite side synchronised and jumping up and clapping hands), strength (standing broad jump and sit up), upper limb coordination (bouncing a ball and catching it with both hands and bouncing a ball and catching it with preferred hand) while fine motor skills test consist of response speed, visual motor control (copping a circle with preferred hand and copping triangle with preferred hand), upper-limb speed and dexterity (sorting shape cards with preferred hand and making dots in circle with preferred hand).

Procedure of the Study

Before going for data collection, getting the approval from the university ethics committee is essential for every research that involves human study. Getting approval from the institution's authority and to sign a consent form and Physical Activity Readiness Questionnaire or PAR-Q by their parents/guardians/caregivers since they are underage, is essential when participating in this study. After obtaining clearance from the children's parents and the school authority, the participants together with their parents, guardians, caregivers and the institution's authority had been briefed about the flow of the session. Before a test started, a warming up session for five minutes been organised to increase the participants body temperature and blood flow in the muscle followed by seven minutes

stretching session. The children had been briefed the procedure of the test and demonstrate the correct procedure on how to perform the test. They undergone all eight tests for fine motor skills and gross motor skills. Each child will be given trials for each test depending on the test procedure. At the end of test, cooling down session for seven minutes been conducted.

Data Analysis

The Statistical Package in the Social Science Software (SPSS) version 29 was used to analyse the current data. The descriptive statistic was used to obtain the frequency, mode, mean, standard deviation and to describe the respondent. The significant difference of fundamental motor skills between genders was analysed using independent t-test. The results were reported by means ± standard deviation and significant $p<0.05$.

RESULTS

Table 1 shows the frequency of gender. From a total of 20 children who participated in this study, 10 were males (50%) and 10 were females (50%) from Persatuan Kanak-Kanak Ampang. They were aged between 14 and 16 years old.

Table 1

Descriptive Statistics of Gender among the Children

		Frequency (n)	Percentage (%)
Gender	Male	10	50
	Female	10	50

Table 2 shows the comparison between the males and the females in terms of mean performance scores. For the Running Speed and Agility Test, the mean score for the males was (mean=.20, SD=.42), while females scored (mean=0.00, SD=0.00) indicating that the males were better than the females. For Test 2 Standing on Preferred Leg on Floor, it shows the mean score for the males (mean=2.00, SD=1.05), while for the females (mean=2.10, SD=0.99) and this shows that the females scored better than the males. The mean score for Test 3 Standing on Preferred Leg on Balance Beam for the males (mean=1.30, SD=0.82) is low as compared to the females (mean=1.60, SD=0.84). Test 4 which is Jumping in Place-Leg and Arm on Opposite Side Synchronised shows that the males scored (mean=.30, SD=0.48) which was lower as compared to the females (mean=.40, SD=0.52). Test 5 Jumping Up and Clapping Hand shows that the mean score for the males (mean=4.20, SD=1.14) was higher as compared to the females (mean=2.90, SD=0.99). As for Test 6 Standing Broad Jump, the mean score for the males (mean=7.40, SD=2.12) is better as compared to the females (mean=4.80, SD=1.93).

Table 2

Descriptive Data on the Performance on BOT-2 between Genders

	Males		Females	
	N=10		N=10	
	Mean	SD	Mean	SD
Running Speed and Agility	0.20	0.42	0.00	0.00
Standing on Preferred Leg on Floor	2.00	1.05	2.10	0.99
Standing on Preferred Leg on Balance Beam	1.30	0.82	1.60	0.84
Jumping in Place-Leg and Arm on Opposite Side Synchronised	0.30	0.48	0.40	0.52
Jumping Up and Clapping Hand	4.20	1.14	2.90	0.99
Standing Broad Jump	7.40	2.12	4.80	1.93
Sit-ups	2.80	1.40	2.70	1.25
Bouncing a Ball and Catching it with Both Hands	2.60	1.08	2.30	0.95
Bouncing a Ball and Catching it with Preferred Hand	2.20	1.32	1.40	1.08
Response Speed	3.50	1.27	3.70	1.83
Copying a Circle with Preferred Hand	1.10	0.32	1.00	0.00
Copying a Triangle with Preferred Hand	1.60	0.70	1.10	1.10
Sorting Shape Cards with Preferred Hand	4.00	2.31	2.60	0.97
Making Dots with Preferred Hand	3.60	1.51	3.20	1.14

For the Sit-ups Test (Test 7), it shows the mean score for the males (mean=2.80, SD=1.40) are better as compared to the females (mean=2.70, SD=1.25). In addition, the mean score for males (mean=2.60, SD=1.08) is better as compared to the females (mean=2.30, SD=0.95) in Test 8 Bouncing a Ball and Catching with Both Hands, while the males also produce better mean score (mean=2.20, SD=1.32) as compared to the females (mean=1.40, SD=1.08) in Test 9 Bouncing a Ball and Catching It with Preferred Hand. The Respond Speed Test (Test 10) shows the mean score for the males (mean=3.50, SD=1.27) are lower as compared to the females (mean=3.70, SD=1.83). Test 11 Copying A Circle with Preferred Hand shows the mean score for the males (mean=1.10, SD=0.32) are slightly better than the females (mean=1.00, SD=0.00). Test 12 Copying a Triangle with Preferred Hand shows the mean score for the males (mean=1.60, SD=0.70) better than that of the females (mean=1.10, SD=1.10). Test 13 Sorting Sharp Cards with Preferred Hand shows the mean score for the males (mean=4.00, SD=2.31) are better than the females (mean=2.60, SD=0.97). Finally, for Test 14 is Making Dots in Circles with Preferred Hand where the mean score for the males (mean=3.60, SD=1.51) are higher as compared to the females (mean=3.20, SD=1.14).

Figure 1 shows the percentage of total score in gross motor skill between genders. In Running and Agility Test, males (100%) outperformed the females (0%). Next, both the males and the females achieve the same percentage score (50%) in Standing on Preferred Leg on Floor Test. In Standing on Preferred Leg on Balance Beam Test, the males achieve lower percentage score (46.47%) as compared to the females (55.15%). Jumping In Place Leg and Arm on Opposite Side Synchronised Test shows the females (75.14%) perform better than the males (42.86%). The males (61.76%) shows a better percentage score as compared to the females (38.23%) in Jumping Up and Clapping Hands Test. The males also achieve better percentage score (60.65%) in Standing Broad Jump Test as compared to the females (39.24%). In Sit-Ups Test, both the males (50.91%) and the females (49.09%) achieve almost equal percentage score.

Figure 1

Percentage of Total Score in Gross Motor Skill between Genders

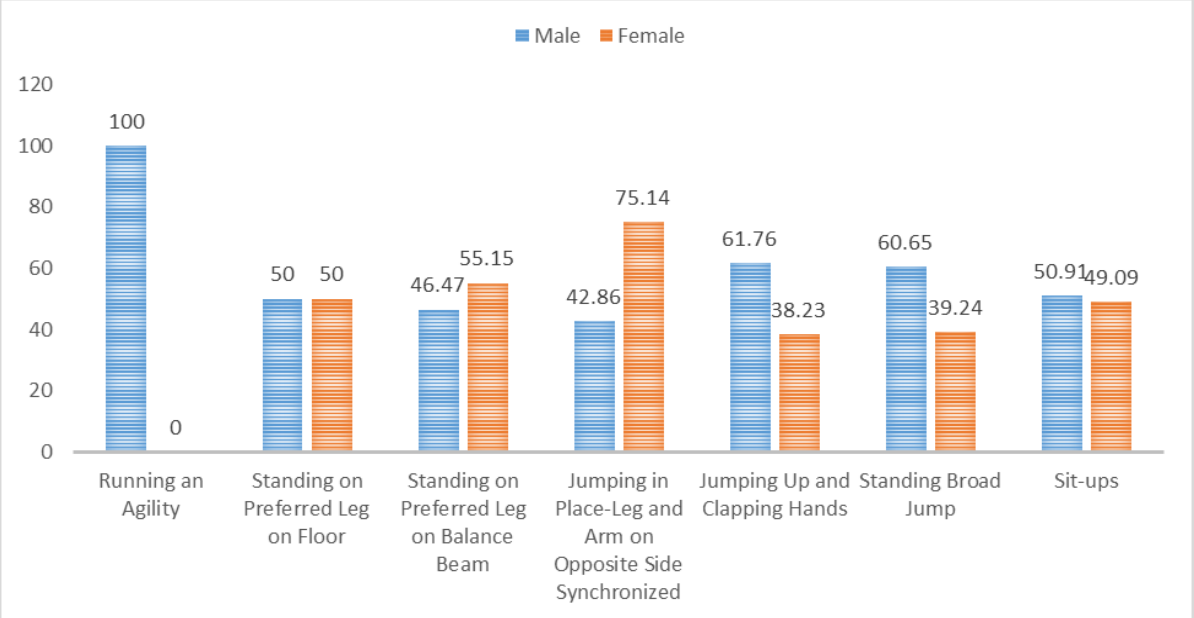

Figure 2 shows the percentage of total score in fine motor skill between genders. The males achieve higher percentage score (53.06%) as compared to the females (46.91%) in Bouncing a Ball and Catching It with Both Hands Test. In Bouncing a Ball and Catching It with Preferred Hands Test, the males (61.11%) outperformed the females (38.89%). Next is the Respond Speed Test, the male's percentage score (48.61%) is found to be lower than the females (51.39%). The male's percentage score (52.3%) is better than the females (47.62%) in Copying a Circle with Preferred Hand Test. Even, the males (57.7%) outperformed the females (42.31%) in Copying a Triangle with Preferred Hand Test. In Sorting Shape Cards with Preferred Hand Test, the males (60.6%) also outperformed the females (39.39%). Finally, the males (51.51%) and the females (48.48%) achieve almost equal percentage score in Making Dots with Preferred Hand Test.

Figure 2

Percentage of Total Score in Fine Motor Skill between Genders

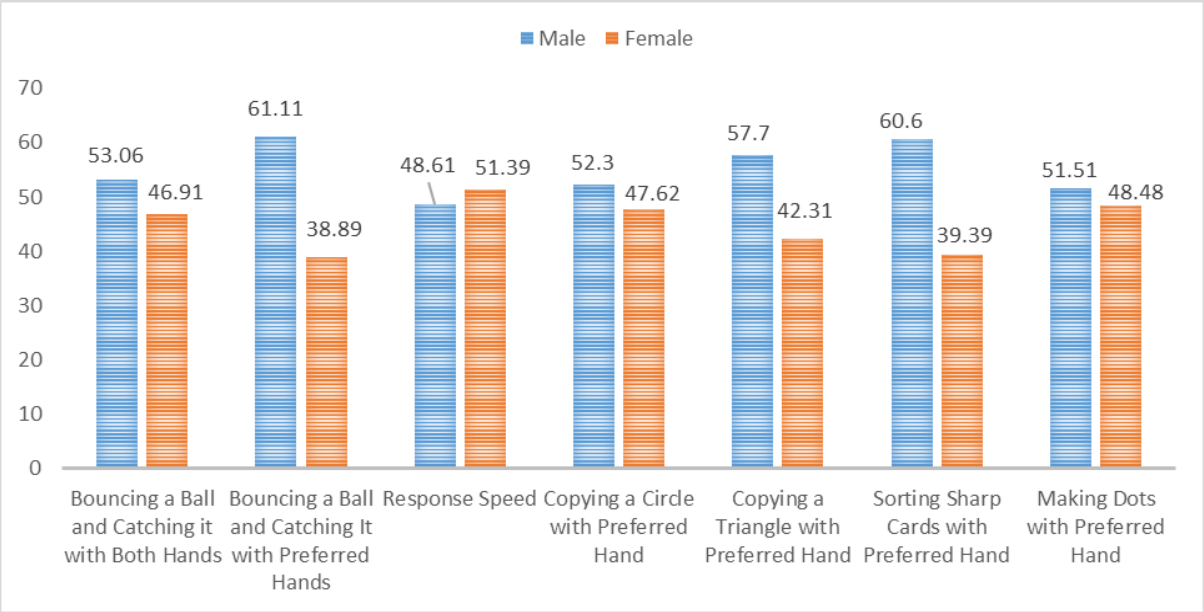

Table 3 shows the difference in FMS proficiency between genders. Significant differences were found in Jumping Up Test and Clapping Hand and Standing Broad Jump Test. Jumping and Clapping Hand Test showed significantly high performance in males (mean=4.20, SD=1.14) as compared to the females (mean=2.90, SD=0.99) with $t(18)$ =2.72, p<0.05. Males showed significantly higher score in Standing Broad Jump Test (mean=7.40, SD=2.12) as compared to the females (mean=4.80, SD=1.98) with $t(18)$ =2.87, p<0.05.

Table 3

Comparison of Fundamental Motor Skills Proficiency between Genders among the Respondents

		Mean (SD)	t	df	*p*
Running Speed and Agility	Males	0.20 (0.42)	1.50	18	.151
	Females	0.00 (0.00)			
Standing on Preferred Leg on Floor	Males	2.00 (1.05)	-0.22	18	.830
	Females	2.10 (0.99)			
Standing on Preferred Leg on Balance Beam	Males	1.30 (0.82)	-.81	18	.431
	Females	1.60 (0.84)			
Jumping in Place-Leg and Arm on	Males	0.30 (0.48)	-.45	18	.660

Opposite Side Synchronised	Females	0.40 (0.52)			
Jumping Up and Clapping Hand	Males	4.20 (1.14)	2.72	18	.014*
	Females	2.90 (0.99)			
Standing Broad Jump	Males	7.40 (2.12)	2.87	18	.010*
	Females	4.80 (1.93)			
Sit-ups	Males	2.80 (1.40)	.17	18	.868
	Females	2.70 (1.25)			
Bouncing a Ball and Catching it with Both Hands	Males	2.60 (1.08)	.66	18	.517
	Females	2.30 (0.95)			
Bouncing a Ball and Catching it with Preferred Hand	Males	2.20 (1.32)	1.49	18	.154
	Females	1.40 (1.08)			
Response Speed	Males	3.50 (1.27)	-.28	18	.780
	Females	3.70 (1.83)			
Copying a Circle with Preferred Hand	Males	1.10 (0.32)	1.00	18	.331
	Females	1.00 (0.00)			
Copying a Triangle with Preferred Hand	Males	1.60 (0.70)	2.06	18	.054
	Females	1.10 (1.10)			
Sorting Shape Cards with Preferred Hand	Males	4.00 (2.31)	1.77	18	.094
	Females	2.60 (0.97)			
Making Dots with Preferred Hand	Males	3.60 (1.51)	.67	18	.511
	Females	3.20 (1.14)			

Other FMS proficiency reported no significant difference. Specifically, there was no significant difference for Running Speed and Agility Test with $t(18)=1.50$, $p>0.05$, Standing on Preferred Leg on Floor Test, with $t(18) = -0.22$, $p>0.05$, Standing on Preferred Leg on Balance Beam Test, with $t(18) = -0.81$, $p>0.05$, Jumping in Place-Leg And Arm on Opposite Side Synchronised Test, with $t(18) = -0.45$, $p>0.05$, Sit-Ups Test, with $t(18) = 0.17$, $p>0.05$, Bouncing a Ball and Catching It with Both Hands Test, with $t(18) = 0.66$, $p>0.05$, Bouncing a

Ball and Catching It with Preferred Hand Test, with $t(18) = 1.49$, $p>0.05$, Response Speed Test, with $t(18) = -0.28$, $p>0.05$, Copying a Circle with Preferred Hand Test, with $t(18) = 1.00$, $p>0.05$, Copying a Triangle With Preferred Hand Test, with $t(18) = 2.06$, $p>0.05$, Sorting Shape Cards with Preferred Hand Test, with $t(18) = 1.77$, $p>0.05$ and Making Dots With Preferred Hand Test, with $t(18) = 0.67$, $p>0.05$.

DISCUSSION

FMS are basic movement skills (i.e. locomotor, object control, and balance skills) that are crucial to childhood development. However, it is often an overlooked aspect of motor development in children with ASD. Gaining a deeper insight into movement skills dysfunction can contribute to the identification of specific movement-related markers of ASD, which in turn may facilitate earlier diagnosis and development of innovative treatment strategies.

In general, most children with ASD did not achieve the FMS proficiency level. The current study indicate that the males perform better than the females with the better scores in 10 tests such as running speed and agility, jumping up and clapping hand, standing broad jump, sit-ups, bouncing a ball and catching it with both hands, bouncing a ball and catching it with preferred hand, copying a circle with preferred hand, copying a triangle with preferred hand, sorting shapes cards with preferred hand and making dots in circle with preferred hand while the females only perform better in four tests such as standing on preferred leg on floor, standing on preferred leg on balance beam, jumping in place-leg and arm on opposite side synchronized and lastly is respond speed. The past study by Jimenez et al. (2015) agree with the findings that the males outperformed the females in running, jumping, and over arm throwing. Even the males also outperformed the females in object control.

When comparing the findings among the gender, the current study reveals a higher score been achieved in the tests among the males with ASD are: Jumping Up and Clapping Hand, Response Speed and Sorting Shape Cards with Preferred Hand tests while the females get a better score in Standing Broad Jump Test. The males also achieve a lower score in Running Speed and Agility, Jumping in Place-Leg and Arm on Opposite Side Synchronised tests while the females did achieve a lower score in the same test. Most probably, the social factor is a main reason on the children's performance as has been highlighted by Jimenez et al. (2015). This is consistent with the past study that indicate that majority of children with ASD were unable to perform the skills in the TGMD-2. Their low scores reflect the poor quality of how they performed the skills; with some of the skills there appeared to be consistent qualitative differences. They had particular difficulty coordinating movements that involved both sides of their body or both arms and legs (Staples & Reid, 2010).

The current study reveal that there is no significant different between the females and the males in Balance Test but there is a significant different on Throwing and Catching Test, and this is consistent with the past study by Pahlevanian and Ahmadizadeh (2014). The current study shows that there is a significant different in Jumping Up and Clapping Hands Test ($t=.014$, $p<0.05$), Standing Broad Jump Test ($t=.101$, $p< 0.05$) and Copying a Triangle with Preferred Hand Test ($t=.054$, $p< 0.05$) while the rest of the tests are not significant. Some past study also agree with the current study where the performance in fundamental

motor skill is closely related with the socio-economic and level of education by their parents and social culture as explained by Bardid et al. (2013).

The current study identified that there are barriers of limitation to participate in physical activity among children with ASD where they show poor range motor skills and this cannot directly attribute to their cognitive level. Alternatively, the extent of these differences seemingly indicates different patterns, or potential deficits, in the development of fundamental movement skills (Staples & Reid, 2010). For example, performance on object control for the children with ASD is quite difficult, where they need series of practise and have experiencing the skill. Staples and Reid (2010) did mention the level of performance is better concurrent with their increment of age due to lack of practice among children with ASD. Therefore, the current study suggested that the instruction during learning process also play an importance role for children that possess deficit on the performance but again need to be patients and tolerated with them because they have different level of understanding the movement. Instruction for individuals with a deficit in development would be individualized, based on the current strengths and levels of functioning unique to each individual, rather than on typical patterns, per se. Instruction would continue to be an important aspect of learning, but would be tailored to the child's level of understanding, preferred methods of communication, and would be systematic to allow the child to focus on one thing at a time (Staples & Reid, 2010). The results of the review conducted by Gantodra et al. (2020) showed that majority of the children with ASD demonstrated significant impairments in FMS that lasts throughout childhood. Compared to their typically developing peers, a larger number of children in the ASD group were found to have greater impairments across all the categories of FMS, even after controlling for IQ scores, indicating that cognitive abilities alone cannot explain movement skills difficulties among children with ASD. Children with ASD were also found to have delayed developmental trajectories of FMS from an early age (MacDonald et al., 2013), with the delays becoming increasingly pronounced with age. School-age children (between nine and 12 years old) with ASD performed movement skills similar to typically developing children approximately half their chronological age (example four to six years old) (Staples & Reid, 2010). This increase in movement delays with age is indicative of the slow development of FMS in children with ASD, which is potentially due to severe dysfunctions in cerebellar and basal ganglia circuitry of ASD children (Gantodra et al. 2020). Other factors that may contribute to the slowing of the development of FMS are impairments in imitation and perceptual-motor skills which are inherent characteristics of ASD and play a pivotal role in learning FMS (Vanvuchelen et al., 2007).

Past study indicate that, the males with ASD show a better performance as compared to the females but the females perform better motor skill when their age reach 13 years old and above but the males perform better motor skill when their age reach seven until 11 years old. (Pahlevanian & Ahmadizadeh, 2014). Even a past study by Jimenez et al. (2015) did mention that the adolescent male group exhibited the highest percentage of achievement while the children and young-adult female group showed the lowest percentage. Due to these results and the relationship between physical activity and motor competence, they believe that this level of performance may contribute to a sedentary behaviour. When analysed by individual skills and age difference, adolescents and young-adults outperformed children in galloping, and also only in this skill did the young-adults achieve a proficiency level. A similar outcome shows by Barnett et al. (2010) and Hardy et al. (2012) when assessing locomotor skills in children and adolescents. In addition, they reported that in kicking, all age-groups achieved a proficiency level and young-adults had a better performance than children and adolescents. In

contrast, Barnett and colleagues (2010) found that kicking had a low percentage of improvement from childhood to adolescence, compared to other skills like catch and throw.

RECOMMENDATIONS

If teachers understand how to enhance the basic fundamental motor skill, it is easier for children to participate in physical activity. It is known that FMS ability is not age-dependent and does not develop naturally. Also, the task, the individual, and the environment have an important role in the performance of motor skills (Jimenez et al., 2015). Furthermore, proficiency level can be achieved with adequate practice, instruction and learning opportunities (Logan et al., 2012; Lubans et al., 2010). Consequently, a possible explanation of these findings is that children, adolescents, and young-adults are not receiving adequate practice, instructions, or learning opportunities to improve their FMS ability. It is very important the FMS been included in the Physical Education class (Carley, 2010). This is because it can help children to develop their fundamental motor skill. In addition, children with disability are less active than children without disability because of the level of FMS proficiency. Therefore, acquiring FMS is essential especially when dealing with physical activity, social, and emotional health among children with ASD. This is in consideration of the increasing evidence that early difficulties in basic motor skills could significantly hinder the development of socio-communicative skills and could even have a role in the pathogenesis of the disorder (Ceccarelli, 2020). Several studies do report that there are some positive effects of motor training on social skills and mannerism, as assessed by parents, and on imitation skills and engagement in peer interaction, as rated through direct observation. Some findings are in line with the recent suggestions of Reinders and colleagues (2019) which further documented the bidirectional relationship between social functioning and physical activity. However, considering the studies that described positive findings, there are a number of inconsistencies between the scores of the different measures used to assess social and communicative skills (Ceccarelli, 2020). Past studies do report that the dimensions such as socio-communication and adaptive functioning are complex to be quantified and the measures currently used for evaluating core features of ASD could be not sensitive enough to detect immediate changes after a specific, brief FMS training (Ceccarelli, 2020).

Children with ASD need to engage with physical activity, so that they can raise the level of their gross and fine motor skills. The teachers at the centres/institutions need to acquire knowledge on learning activities that can enhance the level of FMS among children with ASD. Government needs to create modules/learning courses in physical activity and sports for teachers who are dealing with children with disabilities. This is to ensure that the teachers have the idea and creativity when comes to designing and implementing activities to develop the children's physical fitness and skills.

LIMITATION

One limitation discovered in this study is that there is barrier in communication during conducting this study. This is because children with ASD do not understand the instruction of the test. Similarly, majority of children with ASD begin to speak later than their typically developing peers and considerable variability exists in the rate at which language develops. Therefore, using a simple language can help children with ASD to understand the instruction and to avoid them to skip some of the tests.

CONCLUSION

FMS is important in children's daily life because it involves the overall limbs movement include leg, feet, trunk, arm and hand. The findings from this study suggest that performance of fundamental movement skills among most children with ASD is considerably delayed by late childhood. FMS helps in improving coordination, flexibility, balance, agility and speed among children with ASD because they possess a low level of FMS including fine and gross motor skill. Therefore, teacher need to be trained to conduct and evaluate the FMS development and provide motor skill intervention for children with ASD. Lastly, if FMS is delayed early in life, it may affect health status of this population because FMS have relationship between physical activity and lifestyle in life.

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