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Effects of Parent-child Physical Activity Intervention on Gross Motor Skills among Preschoolers in China

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Abstract

The purpose of this quantitative study is to investigate the effect of parent-child physical activity intervention on children's gross motor skills including child's locomotor and child's object control skills. A total of 64 children aged 5 to 6 and their parents from Changzhi city in China were divided into two group to participate in the experimental parent-child physical activity intervention program in this study. The Test of Gross Motor Development-2 was used in the pre-test and pro-test of experiments. The findings show that parent-child physical activity intervention program had a significant effect on children's gross motor skills including children's locomotor skills and the object control skills. The findings indicated that it is necessary for parents to provide opportunities for their children to engage in physical activity that promote a diversity of motor skills.

Introduction

Global intensities of children overweight and obesity have increased dramatically in recent decades (De Onis et al., 2010; Hesketh et al., 2017; Martin et al., 2018; WHO, 2020; Martin et al., 2018). In 2019, according to the report of World Health Organization (WHO), an estimated 38.2 million children under the age of 5 years were overweight or overweight (WHO, 2020). According to the investigation of De Onis et al (2010) from 140 countries, 43 million children (35 million in developing countries) were estimated to be overweight and 92 million were at risk of overweight.

In China, the Report on Childhood Obesity in China (2017) has pointed out that the rate of childhood obesity is rising (Draper, et al., 2017). In 2017, the obesity rate of children aged 0 to 7 in main cities is about 4.3%, and the rate of obesity for school-age children over 7 years old is about 7.3%. It has been estimated that there are 4.76 million obese children between 0 and 7 years old, and 34.96 million overweight and obese school-age children. If effective intervention measures are not taken, this data may continue to rise considerably higher rates.

The results confirm the need for effective interventions starting early childhood to reverse anticipated trends (Draper, et al., 2017).

With the gradual improvement of living standards and the incessant improvement of urban public facilities, many parents take their children out with different transportation such as car, bus, and underground train. There is an elevator for the means of transportation to go home, which imperceptibly lessens the opportunity for children to exercise in daily life (Li & Wang, 2022). It is not difficult to find that young children need to take part in physical activity to improve their physical and cerebral health.

On the other hand, in the face of today's increasingly competitive society, many parents are shrouded in anxiety and worry that their children will lose at the starting line, many preschool children are experiencing outdoor games and activities time along with physical exercise being engaged by training classes and specialty classes (Sun & Fan, 2019). Due to inadequate awareness of fitness among parents, lack of sufficient attention to the value of physical exercise for preschool children, and unnecessary protection and care, the opportunities for preschool children to participate in physical activities are nearly inadequate to a certain extent (Sun & Fan, 2019).

Gross motor skills are main indicators of the level of growth and development for a child (Engel, et al., 2018). Developing children's motor skills can shrink probabilities of the burden of childhood obesity and developing insalubrious physical activity (Aadland, et al., 2017; Sun and Fan, 2019). Moreover, gross motor skills can help in enhancing the development of long-term health results in children and adolescents (Robinson et al., 2015; Cattuzzo, et al., 2014; Engel, et al., 2018).

Young children have the developmental prospective to master most fundamental motor skills by 6 years of age during physical education, physical activity, and sport (O'Brien, Belton, & Issartel, 2016; Valentini, 2016). Although the importance of fundamental motor skills for children's health and development, however, Engel, et al. (2018) have found that there are inadequate studies to measure children's fundamental motor skills and physical activity (Engel, et al., 2018); as well as factors which predict gross motor competence among children (Barnett et al., 2019). Alternatively, more previous research on teachers' contribution in physical education to early gross motor development (Robinson et al., 2012; Brian et al., 2017; Muchlisin, 2020). However, little has been identified about how parents support children's gross motor development at home.

The problem to be addressed in this quantitative quasi-experimental study that lack of parent-child physical activity at home that negatively affects the gross motor development of young children can be attempted. Whereas contemporary studies have reported the influence of home environment on children's gross motor development, most samples of such findings have been limited primarily to infants (Rodrigues et al., 2005; Freitas et al., 2013) and school-aged children who are more than seven years old (Lope et al., 2013; Ferreira, et al., 2018); and the environment of school (Chow, & Louie, 2013). A similar situation in China, there has been minimal research examining the relationship between young children's gross motor development and the parent-child physical activity in home environment in China (Yue & Wang, 2013; Wang et al., 2018).

Literature Review

According to Bronfenbrenner's theory Bronfenbrenner (1979), humans continue to adapt to the environment and society and interact and integrate with the environment and society for a personal context which can influence the development of a child (Watson, 2017). The

development of human movement is the result of the fusion and interaction between human beings and the surrounding environment. The level of movement development is closely related to the relationship between human physical and mental health (Pan, et al., 2022). The significance of the development of children's movements is to improve the coordination of movements, enhance the function of the body's various organs and physical endurance (Li, & Wan, 2020).

Dynamic systems theory (DST) outlines three components including individual, task, and environment that influence the emergence of behavior. These constraints interact with one another to self-organize and create a spontaneous behavior (Newell, 1986). DST provides an explanation for the variability and spontaneous movement that occurs from individual to individual (Colombo-Dougovito, 2016; Colombo-Dougovito, 2017). It is useful in the understanding of how children's gross movement develops and changes. It can provide insight into a child's readiness and cognition to acquire new motor abilities. According to Goodway et al (2019), motor development is influenced by factors such as environment (experience, learning, nurture and extrinsic factors), individual (heredity, biology, nature and intrinsic factors), and task (physical and mechanical factors).

Physical activity enhances young children's development of motor skills, which is responsible for supporting them master the basic movements such as running, hopping and walking as well as concentration and thinking skills (Timmons et al., 2007; Beni, et al., 2017). Parent-child physical activity is a type of family sports which is not only an important cornerstone and support for national health promotion, but also an extension of school sports, which affects the formation of children's lifelong sports awareness and plays a vital role in physical and mental health of students (Li et al., 2022; Neshteruk, et al., 2018).

Although the important of parent-child physical activity have been examined, minimal research is available in relation to the effect of parent-child physical activity on children's gross motor skills in China. Therefore, this study investigated the influence of parent-child physical activity program on 5 to 6 years old children's gross motor skills in China. Therefore, three null hypotheses were drawn:

1. $H_0$1: There is no difference in TGMD scores among children before they take part in parent-child physical activity intervention.
2. $H_0$2: There is no difference in TGMD scores among children after they participate in parent-child physical activity intervention.

Research Methodology

This study used a quasi-experimental, non-equivalent control group design. Sample size was analyzed by G*Power. 64 children and their parents (children's mother or father) in a preschool in Changzhi city Shanxi province China were selected to participate the research. The researcher designed the parent-child physical activity intervention program. Validity and reliability of the intervention was tested in the pilot study process. Test of Gross Motor Development-2 Ulrich (2000) with high validity and reliability was used to test children's gross motor skills level.

Pretest of children's gross motor skills was conducted among control group and experiment group. After that, parent-child physical activity intervention was conducted in two months. Eight times workshops were arranged by researcher in eight weeks. Four parent-child physical activities were implemented in the first month including move in fun, be a bomber, be a football player, be a basketball player. The difficulty of physical activity operation increased weekly. The researcher guided parents how to do the gross motor movement in physical

activity with children including the materials, space need, detail ways and the goal of movement. After the intervention, the researcher measured gross motor development of young children again. Table 1 shows the time schedule of intervention program on gross motor skills including locomotor and object control.

Table 1
Schedule of Intervention Program on Gross Motor Skills

Time	Locomotor	Object Control
First Week	run	overhand throw, underhand roll, kick, stationary dribble
Second Week	run	overhand throw, underhand roll, kick, stationary dribble
Third Week	run, leap	overhand throw, underhand roll, kick, stationary dribble
Fourth Week	run, leap, hop	overhand throw, underhand roll, kick, stationary dribble
Fifth Week	slide, leap, run	striking a stationary ball, catch
Sixth Week	slide, leap, run	striking a stationary ball, catch
Seventh Week	slide, leap, run	striking a stationary ball, catch, overhand throw, underhand roll
Eighth Week	slide, leap, horizontal jump run, gallop,	striking a stationary ball, catch, overhand throw, underhand roll

Research Findings

Table 2 shows the statistics of children' s gender, age, weight and height distribution in treatment group and control group. Based on the data in the table, there was no marked difference in the age mean (F=2.228, P= 0.443>0.05) and gender mean (F=0.122, P= 0.806>0.05) of treatment and control group among children. Besides, there was not statistically difference in children's weight (F=0.364, P= 0.057>0.05) and height (F=0.903, P= 0.807>0.05) between treatment group and control group.

Table 2
Group Statistics of Treatment and Control among Children's Demographic Information

	Group	N	Mean	Std. Deviation	F	t	P
age	treatment group	32	5.59±0.088	.499	2.228	-.773	.443
	control group	32	5.69±0.083	.471			
gender	treatment group	32	1.47±0.09	.507	0.122	-.246	.806
	control group	32	1.50±0.09	.508			
weight	treatment group	32	20.606±0.42	2.3500	0.364	-1.939	.057
	control group	32	21.781±0.44	2.4950			
height	treatment group	32	113.53±0.76	4.295	0.903	-1.741	.087
	control group	32	115.50±0.84	4.738			

In order to test whether the development level of children's gross motor skills is homogeneous, baseline measurements of children's gross motor skills were tested for every

respondent. Children's locomotor skills and object control skills between treatment group and control group were tested by independent samples T-test and are shown in Table 3 and Table 4.

Table 3
Baseline Children's Locomotor Skills Between Treatment and Control Groups

	Group	N	Mean	Std. Deviation	F	t	P
Run	treatment group	32	3.47±.238	1.344	1.622	-1.246	.217
	control group	32	3.88±.223	1.264			
Gallop	treatment group	32	3.22±.199	1.128	.015	-.110	.912
	control group	32	3.25±.201	1.136			
Hop	treatment group	32	4.25±.215	1.218	2.287	.092	.927
	control group	32	4.22±.261	1.475			
Horizontal jump	treatment group	32	3.25±.215	1.218	.833	-.214	.832
	control group	32	3.31±.198	1.120			
Leap	treatment group	32	2.28±.121	.683	13.702	-1.786	.080
	control group	32	2.69±.193	1.091			
Slide	treatment group	32	3.00±.168	.950	11.054	-1.559	.125
	control group	32	3.50±.273	1.545			
Standard score	treatment group	32	4.72±.247	1.397	2.911	-1.128	.264
	control group	32	5.19±.334	1.891			

Table 4
Baseline Children's Object Control Skills Between Treatment and Control Groups

	Group	N	Mean	Std. Deviation	F	t	P
Striking stationary ball	atreatment group	32	3.59±.257	1.456	.883	.490	.626
	control group	32	3.41±.283	1.604			
Stationary dribble	treatment group	32	3.09±.203	1.146	1.362	-.227	.821
	control group	32	3.16±.186	1.051			
Catch	treatment group	32	3.16±.216	1.221	5.536	-1.581	.119
	control group	32	3.59±.173	.979			
Kick	treatment group	32	3.28±.186	1.054	.562	.989	.327
	control group	32	3.03±.171	.967			
Overhand throw	treatment group	32	3.06±.195	1.105	1.031	-.482	.632
	control group	32	3.19±.171	.965			
Underhand roll	treatment group	32	2.78±.184	1.039	.098	-1.304	.197
	control group	32	3.13±.189	1.070			
Standard score	treatment group	32	5.56±.345	1.950	1.916	-.559	.578
	control group	32	5.81±.286	1.615			

Table 3 and Table 4 indicated that there was no difference in the locomotor skills and object control skills between the treatment group and the control group before the experimental intervention (P>0.05). In conclusion, there is no difference in the gross motor skills level between the experimental group and the control group before the intervention, and the intervention of parent-child physical activity can be carried out. The first null hypothesis

"there is no difference in TGMD scores among children before they take part in parent-child physical activity intervention" was failed to reject.

Table 5 shows the converting sums of subtest standard scores to percentiles and quotients. According to the independent-samples T-test of TGMD, the P value of pre-test is 0.326 which is more than 0.05. It indicates that there is no obvious difference between control group and treatment group before intervention. After parent-child physical activity intervention, the result of TGMD is different between control group and treatment group.

Table 5
Independent-samples T-test of TGMD between Two Groups before and after Intervention

	Group	N	Mean	Std. Deviation	F	t value	P
PreQ	treatment group	32	70.84±1.375	7.78	1.115	-.990	.326
	control group	32	73±1.688	9.55			
proQ	treatment group	32	91.28±1.252	7.08	3.933	4.605	.000
	control group	32	80.03±2.098	11.87			

P<0.05

Table 6
Paired Samples Test of TGMD for Treatment Group

		Paired Differences						
		Mean	SD	95% Confidence Interval of the Difference				
				Lower	Upper	t	df	Sig. (2-tailed)
Pair	preQ (M=71.92) – proQ (M=85.66)	-13.734	8.532	-15.87	-11.60	-12.88	63	.000

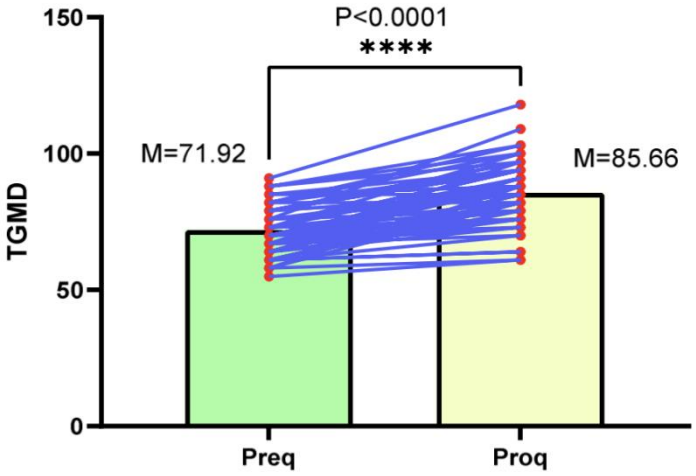

Figure 1. Diagram of Paired Samples Test of TGMD for Treatment Group

Table 6 and Figure 1 presents the converting sums of subtest standard scores to percentiles and quotients. According to paired samples test of TGMD, the P value is at the significant level. There was a significant increase as the score of TGMD [($M_{pre\text{-}pro}$=-13.734, SD=8.532); t (63) =-12.88, by participants after intervention in post-test than that before intervention in pre-test.

Discussions

According to the findings of this study, parent-child physical activity intervention program can improve children's gross motor skills. The results of this study indicate that parent-child physical activity intervention program can improve children's gross motor skills. The results of this study are consistent with the studies of Wang (2004); Robinson (2011) who investigated the effects of a creative movement program on preschool children's gross motor skills and found that gross motor skills can be impacted by an appropriate movement program. This finding partially aligns with previous research of Li et al (2022) who found that parent-child physical activity significantly and positively predicts children's mental health and can also significantly positively predict parent-child relationship and significantly negatively predict subjective academic burden. The findings of this study support previous research of Zhang et al (2022) who acquired the conclusions that children's parent-child orienteering physical activities can help improve children's various motor abilities, especially in balance and speed endurance and Wang et al (2020) concludes that young children with a higher frequency of daily physical activities at home leads to faster motor skill development. Moreover, the finding of this study aligns with previous research of He et al (2022) who conclude that family parent-child physical activity time is significantly correlated with the development of gross motor skills of preschool children, and preschool children with longer parent-child physical exercise have higher levels of gross motor skills development.

Implications

This study indicates that parent-child physical activity in home environment can improve children's gross motor skills. That being said, the chosen theory ecological systems theory and

dynamic systems theory are relevant for the purpose of this study. On the other hand, this study enriches the theories.

From the result of this study, parent-child physical activities can influence children's gross motor skills. However, children's sports activities have not been paid enough attention by parents in China (Huang, 2018). Related research in China mainly stays at the micro level and lack of research at the family, school and social level (Du et al., 2022). Majority of studies focus on 3 to 4 or 3 to five years old children. Lack of study on the effect of parents-child physical activities on young children aged 5 to 6 years old. Majority of the studies were conducted in rich area in China, how about the situation in undeveloped cities in China is unknown. Therefore, the outcomes of the present study can fill the gap that exist in searching research to identify the effect of parent-child physical activities on children's gross motor skills. Moreover, the findings of this research can provide useful data and information as an inspiration and reference for further study.

Children participated in parent-child physical activities improves their gross motor skills and the interest of doing physical activity. The parent-child physical activity program drives the enthusiasm of children taking part in sports activities. Parent-child physical activities are a supplement to school sports, which can not only consolidate the basic sports skills learned in school, but also stimulate children's sports hobbies and interests, and cultivate their ability to study independently.

This research can further enrich the cooperation between kindergartens and families. The findings provide a benchmark for preschools in China regardless of public or private institutions to build a strong relationship with parents to improve children's gross motor skills. Understanding more information of parent-child is better for teachers in preschools to collaborate with parents and improve the teaching for children in the field of physical education. On the other hand, preschool teachers can obtain the information of parent-child activity and improve the artistic and scientific nature of the communication between teachers and parents and promote the development of teachers' professional quality.

Conclusions

The findings show that parent-child physical activity intervention program had a significant effect on children's gross motor skills including children's locomotor skills and the object control skills. The findings indicated that it is necessary for parents to provide opportunities for their children to engage in physical activity that promote a diversity of motor skills.

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