Original Article

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Development and Evaluation of a Basic Physical and Sports Activity Program for Preschool Children in Nursery Schools in Iran: an Interventional Study

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Abstract

Objective: The objectives of this study were a) to develop a physical activity program for nursery schools, and b) to evaluate the effects of this program on fundamental movement skills of preschool age children in Iran.

Methods: In this quasi-experimental study 147 children from five nursery schools in five different cities in Iran were enrolled. A physical activity program was developed for nursery children. Trained nursery physical activity instructors conducted the program for 10 weeks for all subjects. The levels of gross motor development of all subjects were measured before intervention and after 10 weeks physical activity program employing the Test of Gross Motor Development-edition 2 (TGMD-2).

Findings: The participants in this study had a mean (SD) age of 4.95 (0.83) years. At the end of the study, scores of subjects at all components of TGMD-2 (including locomotor, object control, sum of standard scores and gross motor quotient) were significantly improved compared to the baseline scores (P<0.001). Based on descriptive rating of the "Gross Motor Quotient" in the base line, 11.5% of subjects were superior/very superior (GMQ >120) and after 10 weeks intervention this rate was increased to 49.7% of all subjects.

Conclusion: It seems that the developed physical activity program conducted by trained nursery physical activity instructors could be an effective and practical way of increasing levels of fundamental movement skills of preschool children in Iran.

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Key Words: Fundamental Movement Skills; Preschool Age; Physical Activity; TGMD-2

Introduction

Lack of physical activity is a major concern in children. Physical activity during preschool age has significant effects on physical, social and psychological health of children[1]. Fundamental movement skills (FMS) including locomotor (e.g. run, gallop, hop, leap, horizontal jump and slid), object control (e.g. catch, kick, overhand throw and dribble) and body management (e.g. balance, climb and forward roll) provide a base for more advanced physical skills[2]. FMS develop during

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early childhood and are essential for complex activities at adulthood. Proficiency in FMS is essential for practicing different games and sports. Some studies have shown that the level of locomotor skills of children is positively correlated with the levels of participation in physical activities at adulthood[3-4]. D'Hondt et al reported that the levels of gross motor skills in obese children are lower than the levels of these skills in normal-weight children[5]. Therefore it seems likely that more proficient children in FMS are more physically active, have more self confidence, are less obese and would be healthier in their adulthood.

FMS would not be developed naturally as a result of growth and maturation in all children. Proficiency in these skills needs education, exposure, relevant feedbacks and encouragement[2]. It has been suggested that the optimal ages for FMS learning are between 2 to 7 years[2,6]. Brian W et al have recommended that physical activity promotional programs for preschool children should be on base of children's natural activities such as being spontaneous and intermittent. Also preschool children activities should be enjoyable and contain gross motor plays and locomotor activities[7]. Therefore, it seems that an effective physical activity program for preschool children needs to be developmentally appropriate for children in the listed age range. Furthermore, physical, emotional and psychosocial needs of children should be considered in development of appropriate physical activity program for these children.

Ideally physical activity programs in nursery schools should be conducted by trained instructors[8]. Also a well developed training course for these instructors is essential in efficient teaching of movement skills to children in nursery schools[1,9].

In addition to the role of FMS in long-term health, FMS play a cardinal role in physical development of preschool children. To our knowledge there is no national curriculum for preschool children physical activity education in Iranian nursery schools. The objectives of this study were a) to develop a physical activity program for nursery schools in Iran, and b) to evaluate the effects of this program on improvement of fundamental movement skills of preschool children in selected nursery schools in Iran.

Subjects and Methods

This quasi-experimental study evaluated the effect of a 10 weeks physical activity program on fundamental movement skills levels of nursery children in Iran.

The participants were 147 children with age range between 4 to 6 years that were selected by convenience sampling. Children selected form five available nursery schools in five different cities in Iran.

A manual for nursery physical activity instructors was developed by a panel of 20 experts in different related fields in Iran including sports medicine specialist, pediatrician, expert nursery teachers, psychologist, nutritionist, physical education specialist, PhD in sports physiology, and PhD in movement and behavior. This manual contained two parts; a) instructions for nursery physical activity instructors about goals and structure of the program, and materials on children's growth and development, children's nutrition, physical education, psychology of children, and health and safety, b) twenty four sections which cover different lessens containing physical activity and games aimed at developing locomotor and object control skills of children aged 4 to 6 years. Some sections of this package were developed based on the Iranian traditional games and plays that were appropriate for preschool ages.

Five nursery schools were selected in five different cities (Tehran, Isfahan, Shahrood, Neishaboor and Gorgan) and volunteer nursery teachers of these nursery schools were enrolled in an educational course. This one week course was designed to train nursery physical activity instructors to be able to physically train children in nursery based on our designed physical activity

program. The course contained both thought and practical training sessions. The aim of this short-term educational program was to ensure that all physical activity instructors are alert to their duties about implementing of the developed physical activity manual. Also physical activity instructors were educated to test children using the Test of Gross Motor Development-edition 2 (TGMD-2) before and after intervention. This test has been frequently used in numerous studies[10-15]. Persian version of this test has been employed by Akbari H, et al. and Bakhtiari S, et al. in Iran[9,16].

The levels of gross motor development of all subjects were measured before intervention and after 10 weeks physical activity program employing TGMD-2. TGMD-2 was performed by trained nursery physical activity instructors. One person performed both before and after intervention tests in each nursery school.

TGMD-2 is a valid and reliable (test-retest reliability=0.88-0.96) criterion-referenced instrument designed to assess gross motor development among children. TGMD-2 measures 12 gross motor skills levels of children aged 3 through 10 years. TGMD-2 includes two subtests, locomotor and object control. Each subtest consists of 6 locomotor items (run, hop, gallop, leap, horizontal jump, and slide), and 6 object control items (throw, catch, kick, strike, dribble, and roll)[17].

All children were tested according to the TGMD-2 manual. Every test item was performed by children twice. The child was given 0 for unsuccessful attempt and 1 for successful attempt. The sum of both attempts calculated to demonstrate the skill score for each item. Subtest Raw Score was defined by sum of 6 items of each subtests of locomotor or object control (scored between 0-48). Standard scores of each subtest (scored between 0-20) and also gross motor quotient were calculated in accordance with TGMD-2 manual[17].

Descriptive rating of "Gross Motor Quotient" (GMQ) for each subject was reported as very superior (GMQ > 130), superior (GMQ=121–130), above average (GMQ=111–120), average (GMQ=90–110), below average (GMQ=80–89), poor (GMQ=70–79), and very poor (GMQ <70) according to the suggestions of the TGMD-2 manual[17].

According to developed physical activity manual, physical activity program was conducted 5 days a week for 10 weeks by trained nursery physical activity instructors. Duration of each session was 15 to 30 min.

SPSS version 17 was used for descriptive and inferential data analysis. Paired-samples T test was used to determine whether there were significant differences between the levels of locomotor and object control of participants before and after intervention. Independent samples t-test was used to compare differences between boys and girls on variables. $P<0.05$ was considered significant.

This study was approved by the Ethics Committee of Tehran University of Medical Sciences. Parents were informed about this study and informed consents were obtained from them.

Findings

In this quasi-experimental study 147 children with mean (SD) age of 4.95 (0.8) (range 3 - 6) year from five nursery schools in 5 cities in Iran were included. Of all subjects 49% (72) were girls and 51% (75) were boys.

The base line and post intervention TGMD-2 scores of subjects are presented in Tables 1 and 2. In the baseline, there were no statistically significant differences between the locomotor and object control raw scores of boys and girls ($P=0.49$ and $P=0.9$) respectively.

After intervention, differences between the locomotor raw scores of boys and girls were not statistically significant ($P=0.5$). However, there was a statistically significant difference between boys and girls in the object control raw scores ($P=0.048$). The GMQ of all subjects which is the most reliable score of TGMD-2 was statistically significantly increased after 10 weeks of intervention. Both subtests of TGMD-2 including "Locomotor Raw Score" and "Object Control Raw

Table 1: Base line and post intervention TGMD-2 scores of all subjects

Parameter	Pre intervention Mean (SD)	Post intervention Mean (SD)	*P*-value
Locomotor Raw Score	29.7 (11.2)	40.2 (9.4)	< 0.001
Boy	29.5 (11.1)	40.5 (9.1)	< 0.001
Girl	30.0 (11.5)	39.8 (9.7)	< 0.001
Object Control Raw Score	25.4 (9.4)	36.2 (9.1)	< 0.001
Boy	26 (9.3)	37.9 (8.5)	< 0.001
Girl	24.8 (9.5)	34.5 (9.5)	< 0.001
Sum of Standard Scores	17.8 (6.3)	25.9 (6.5)	< 0.001
Boy	17.1 (5.8)	25.5 (6)	< 0.001
Girl	18.5 (6.8)	26.3 (7)	< 0.001
Gross Motor Quotient	93.3 (18.9)	117.7 (19.6)	< 0.001
Boy	91.2 (17.3)	116.5 (18.1)	< 0.001
Girl	95.5 (20.3)	118.9 (21.2)	< 0.001

SD: Standard Deviation

Score" in both genders were statistically significantly increased after 10 weeks of intervention (Table 1).

Descriptive rating of GMQ for subjects before and after intervention is shown in Table 3. Before intervention only 11.5% of all subjects were rated superior/very superior in GMQ scores (i.e. GMQ >120), however this rate increased to 49.7% of all subjects after 10 weeks of intervention. Before the intervention, 26.6% of all subjects were rated as poor/very poor, this rate decreased to 2% of subjects after 10 weeks intervention. Age equivalents of subjects on the locomotor and object control subtests before and after intervention are shown in Table 4. Age equivalents or developmental age defined as "developmental level or age that corresponds to a raw score made by an individual"[17].

Discussion

The main finding of this study was that the developed physical activity intervention program that was focused on gross motor skills development had a significant positive effect on proficiency in fundamental movement skills in preschool children from selected nursery schools in five cities in Iran. Differences in TGMD-2 results before and after the intervention were significant in locomotor, object control, sum of standard cores and gross motor quotient in all subjects. To our knowledge there has been no published data on the levels of physical activity of Iranian preschool children. However, base line TGMD-2 subtests scores of our subjects in this study were in the range of reported data from the United States[17] (Table 5).

Table 2: Means (SD) of base line and after intervention TGMD-2 Raw Scores of all subjects by age and gender

Age	Time of testing	Locomotor		Object control	
		Boys	Girls	Boys	Girls
3	**Base line**	18 (12.5)	3 (1.4)	22 (12.8)	12 (5.7)
	Post intervention	33.5 (11.7)	11 (1.4)	32.5 (8.7)	20 (5.7)
4	**Base line**	21.5 (13.2)	28.3 (13)	24.2 (8.9)	24.6 (11.1)
	Post intervention	35.8 (13.4)	40.1 (9.8)	35.8 (7.8)	34.1 (10.1)
5	**Base line**	31.4 (10.1)	31.8 (10)	26.2 (9.5)	26.4 (9.5)
	Post intervention	41 (7.7)	41.3 (6.9)	37.8 (8.6)	35.4 (9.4)
6	**Base line**	33.7 (6.5)	31.9 (8.5)	27.5 (8.7)	23.4 (6.4)
	Post intervention	44 (4.8)	40 (9.9)	40.3 (8.3)	34.9 (8.5)

SD: Standard Deviation

Table 3: Descriptive rating of the Gross Motor Quotient of all subjects before and after intervention

Category (Gross Motor Quotient)	Pre intervention % (n)	Post intervention % (n)
Very superior (>130)	2.0 (3)	28.6 (42)
Superior (121-130)	9.5 (14)	21.1 (31)
Above average (111-120)	5.4 (8)	15 (22)
Average (90-110)	41.5 (61)	25.2 (37)
Below average (80-89)	15.0 (22)	8.2 (12)
Poor (70-79)	18.4 (27)	2 (3)
Very poor (<70)	8.2 (12)	0 (0)
Total	100 (147)	100 (147)

Our data suggested that a supervised physical activity program could increase these scores to be better than normative reported data. There was no significant difference in the base line mean of the locomotor and object control raw scores between girls and boys (30 vs 29.5) and (24.8 vs 26), respectively. However after the intervention the mean of both object control raw scores (P=0.048) and object control standard scores (P=0.02) in girls were higher than these scores in boys. This is a controversial area in the literature. Cliff et al have reported that locomotor raw score in preschool children was higher in girls compared with boys but there was no significant difference between girls and boys in the object control raw score[18]. In this study, base line means of standard scores of the locomotor (9.3 vs 8.9), object control (9.1 vs 8.1) and GMQ (95.5 vs 91.2) were not significantly different between girls and boys. In contrast Cliff et al have reported significant differences between girls and boys in the mean of locomotor standard scores (9.9 vs 7.9), object control standard scores (10.1 vs 8.6) and GMQ (99.7 vs 88.2)[18]. One study has reported that locomotor skills proficiency is higher in girls and in contrast boys are more proficient in object control skills[8].

The level of FMS is an important factor in physical activity promotion in children. Some studies have suggested that the levels of moderate and vigorous physical activities in children with better motor performance are significantly higher than the levels of these activities in children with less developed skills[4,19]. Therefore, conduction of a physical activity program such as the program used in this study may help children to improve their FMS which may help to have a higher physical activity in their future.

There were several limitations in this study. First, same person conducted both training sessions and outcomes measurement in each nursery school. Second, the follow-up time was

Table 4: Age equivalents for locomotor and object control raw scores according to age groups of all subjects before and after intervention

Age equivalents year-month	Locomotor raw scores		Object control raw scores	
	Before intervention % (n)	After intervention % (n)	Before intervention % (n)	After intervention % (n)
> 10.9	1.4 (2)	12.9 (19)	0.7 (1)	8.8 (13)
9 – 10.9	6.8 (10)	36.7 (54)	0.7 (1)	27.9 (41)
7 – 8.9	4.8 (7)	12.9 (19)	10.9 (16)	19.0 (28)
5 – 6.9	46.9 (69)	25.9 (38)	33.3 (49)	24.5 (36)
3 – 4, 9	24.5 (36)	5.4 (8)	36.1 (53)	17.7 (26)
< 3	15.6 (23)	6.1 (9)	18.4 (27)	2.0 (3)
Total	100 (147)	100 (147)	100 (147)	100 (147)

Table 5: Comparison of TGMD-2 standard scores of subjects in this study with reported data from the United States, mean (SD)

Subtest	This Study		European American [17]	African American [17]	Hispanic American [17]
	Baseline	After Intervention			
Locomotor	9 (4)	14 (4)	10 (3)	11 (3)	10 (3)
Object Control	9 (3)	12 (3)	10 (3)	10 (3)	10 (3)
Gross Motor Quotient	93 (19)	118 (20)	99 (15)	101 (15)	100 (13)

SD: Standard Deviation

relatively short. We just evaluated the short-term effects of physical activity program. Third, this study did not have control group. Furthermore, to our knowledge there was no normative data of TGMD-2 for Iranian children to be used for comparison with our data.

Further studies are needed to evaluate the long-term effects of physical activity intervention on FMS in Iran.

Conclusion

It seems that our developed physical activity program conducted by trained nursery physical activity instructors could be an effective and practical way of improving gross motor skills of preschool children in short term in Iran. Conduction of this program in nursery schools could indirectly help with increasing health levels and levels of physical activities in the society. We recommend using of this kind of physical activity programs in all nursery schools in Iran and similar counties.

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Conflict of Interest: None

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