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Fundamental Motor Skill Development and Its Influencing Factors Among 3–6-Year-Old Preschool Children in Xizang

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Abstract: Children aged 3-6 years old are in a crucial period for the development of fundamental motor skills (FMS), which provide the basic foundation for young children to participate in exercise and learn sports-related motor skills. To examine the current state of motor development in preschool children from the Tibetan Autonomous Region, this study used the TGMD-3 assessment to evaluate 204 Tibetan children aged 3-5 years at a kindergarten in City L, Xizang. The total proportion of participants who could master FMS was 42.6%, which is relatively low; their locomotor skills were better developed than their object-control skills. Age was associated with a change in FMS scores; however, at all ages, there was no difference between men and women. Based on the theory of dynamic systems, the motor development of plateau preschoolers is the result of the combined influence of several factors, such as their own traits, family circumstances, kindergarten life and the high-altitude environment.

Keywords: Tibetan preschoolers aged 3–6 years; Fundamental motor skills; Locomotor skills; Object-control skills

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1. Introduction

The Healthy China 2030 Outline has released a national initiative to promote physical exercise for children and teenagers and encourage young people to learn standard motor skills [1]. Motor competence refers to the combination of movement skills and physical fitness; therefore, good foundational motor skills (FMS) in childhood provide the necessary foundation for learning various advanced sport-specific skills later in life. At present [2,4], some preschool and school physical education activities focus too much on specialised sports training and short-term performance results, thereby impeding the all-round development of children's motor skills. The special high-altitude, hypoxic and cold climate in Xizang, along with its own ethnic culture and regional preschool education resources, provides a unique developmental environment for local preschoolers that is significantly different from that of children in the plains. According to the Test of Gross Motor

Development-3 (TGMD-3), this study will systematically assess the FMS abilities of preschool children in the city of Xizang and describe their development patterns in motor skills. The results provide experimental support and theoretical ideas for strengthening the promotion of motor development in local preschool children.

2. Materials and methods

2.1. Participants

Stratified Random Sampling was used to recruit Tibetan preschool children aged 3-6 from a kindergarten in City L, Xizang. The first sample of 210 children was collected, and six were excluded because they had not finished all the test items. The final valid sample included 204 children with a mean age of 4.58 ± 0.80 years and 102 boys and 102 girls. The 74 children in the junior class, 70 in the middle class, and 60 in the senior class were selected as samples; among them, 53 were aged 3, 84 were aged 4, and 67 were aged 5. All the participants were in good health, without any limb disabilities or serious organ diseases, and could participate in all parts of the test.

2.2. Instrument

The Third Edition of the Test of Gross Motor Development (TGMD-3) by Ulrich [3] was used in this study. The two subdomains of this instrument are locomotor skills and object-control skills, and there are a total of 13 test items [5] for children aged 3-10 years. Sub-domains of locomotor skills are: running, galloping, hopping, leaping, horizontal jumping and sliding. The sub-domains of object-control skills include: striking a stationary ball, dribbling a stationary ball, catching a ball, kicking a stationary ball, overhand throwing, underhand rolling and striking a bouncing ball. Each item was shown twice, and then, according to the standardised performance indicators, individually scored. Mastery of a skill item is achieved by obtaining the top score or a score one point below the maximum. A group of children was considered to have achieved overall mastery of a particular skill when more than 60% of the children could do so [67].

2.3. Testing procedure

All testers received unified training on the theory, skill demonstration and scoring rubric of TGMD-3 before being qualified for the group data collection. Written informed consent was obtained from the kindergarten administration and parents/guardians before the test. Testers gave standardised demonstrations of the skills in data collection. All children took two formal test rounds, the raw scores were recorded on-site, and all the datasets were compiled after the test.

2.4. Data analysis

Raw data were entered into Microsoft Excel to build a database, and then SPSS software was used for statistical analysis. The average, standard deviation, and mastery rate were calculated as descriptive statistics. One-way analysis of variance (ANOVA) was used to examine the difference in scores among age groups, and independent-samples t-tests were employed to compare the performance of boys and girls. The significance levels were set at $p < 0.05$, $p < 0.01$, and $p < 0.001$.

3. Results

3.1. Overall characteristics of fundamental motor skills among Xizang preschool children aged 3–6 years

A considerable amount of domestic empirical research using the TGMD-3 has found that object-control skills are a general developmental deficiency among Chinese preschoolers; these skills require a relatively high degree of hand-eye coordination and limb-equipment coordination, and locomotor skills generally show better performance [8-10]. The current sample of Tibetan preschoolers also showed this developmental pattern.

The total proportion of Tibetan children who had mastered the basic motor skills (FMS) was 42.6%, which was relatively low in development. The proportion of students who had mastered locomotor skills was 52.0%, and only 34.5% had mastered object-control skills. The Mastery Rates for Run and Slide were 76.7% and 74.0%, respectively. The top rate of the seven object-control items was less than 60 percent. The overhand throw and strike of a bouncing ball showed the lowest mastery levels at just 16.0% and 16.1%, respectively, and were generally inferior to those of preschool children in the plain regions of China.

Table 1. Mastery of fundamental motor skills among preschool children

Motor skill	M±SD	Maximum score	Percentage of children achieving mastery
Run	6.74±1.078	8	76.7%
Gallop	4.08±1.681	8	51%
Hop	2.19±1.487	8	27.3%
Leap	1.53±0.954	6	25.5%
Horizontal jump	3.44±1.372	8	43%
Slide	5.92±1.910	8	74%
Strike stationary ball	3.59±1.226	10	35.9%
Dribble ball stationary	2.17±1.760	6	36.2%
Catch ball	3.34±0.769	6	55.7%
Kick stationary ball	4.03±0.985	8	50.4%
Overhand throw	1.28±0.539	8	16.0%
Underhand roll	2.94±1.072	8	36.8%
Strike bouncing ball	1.29±0.729	8	16.1%
Locomotor skills	23.90±6.189	46	52.0%
Objectcontrol skills	18.65±4.561	54	34.5%
Fundamental motor skills	42.55±9.947	100	42.6%

Locomotor skills mainly require control over one's own body without manipulating equipment. By contrast, objectcontrol skills demand upper and lowerlimb coordination, handeye integration and humanequipment interaction, which place greater requirements on neuromuscular control. Although highaltitude kindergartens guarantee basic outdoor playtime for children, outdoor activities are dominated by unstructured running and jumping. Systematic instruction and sufficient practice opportunities for objectcontrol movements are scarce, rendering objectcontrol skills a pronounced developmental deficit. Furthermore, fundamental motor skills do not mature automatically with physical growth. Movement experience and educational intervention play critical roles. Children's motor proficiency cannot be judged solely by chronological age; standardized assessment tools are mandatory for objective evaluation.

3.2. Agerelated differences in fundamental motor skills

Oneway analysis of variance revealed an extremely significant main effect of age on locomotorskill scores, objectcontrolskill scores and total fundamental motor skill (FMS) scores ($p < 0.001$). Children's motorskill scores increased markedly with advancing age. The 3yearold group obtained the lowest scores across all domains; scores rose steadily at 4 years of age and peaked at 5 years within the sample. Agerelated gains in muscular strength and balance control were observed with maturation. Tibetan preschoolers living on the plateau followed the general developmental pattern of progressive improvements in motor performance with age.

Table 2. Mean fundamental motorskill scores and posthoc LSD comparisons across age groups

Age group	N	Locomotor skills		Objectcontrol skills		Fundamental motor skills	
		Mean ± SD	LSD	Mean ± SD	LSD	Mean ± SD	LSD
3	53	17.32±3.642		14.36±2.220		31.68±4.918	
4	84	23.67±4.717	3<4<5	17.74±3.458	3<4<5	41.40±6.932	3<4<5
5	67	29.39±3.737		23.19±2.872		52.58±5.108	

3.3. Gender differences in fundamental motor skills

Independentsamples ttests indicated no statistically significant gender differences in locomotorskill scores, objectcontrolskill scores or total FMS scores ($p > 0.05$). Girls exhibited slightly higher mean scores in all domains than boys, yet these differences did not reach statistical significance. In the cold highaltitude setting, caregivers tend to restrict boys' vigorous outdoor chasing and risky play owing to safety concerns. By contrast, girls frequently participate in household chores, traditional handicrafts and collaborative group games, which provide opportunities to practise limb coordination. This local rearing environment narrows genderbased gaps in motor performance and moderates the typical gender effect on motor competence.

Table 3. Comparison of fundamental motor skills between boys and girls

Variable	Gender	N	M±SD	T	*P*
Locomotor skills	Boys	102	23.77±6.356	-0.282	0.778
	Girls	102	24.02±6.046		
Objectcontrol skills	Boys	102	18.55±4.411	-0.322	0.748
	Girls	102	18.75±4.725		
Fundamental motor skills	Boys	102	42.32±10.027	-0.323	0.747
	Girls	102	42.77±9.910		

*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$

4. Analysis of factors influencing fundamental motor skill development in 3–6yearold preschool children

Based on an analysis of the overall fundamental motor skill (FMS) profiles of 3–6yearold preschool children in Xizang, semistructured interviews with kindergarten principals, teachers and caregivers, and a systematic review of existing literature, the present study identified individual and external determinants of FMS development among local preschoolers. External factors were further discussed mainly from two dimensions: the family environment and kindergarten physical activity settings [1113].

4.1. Effects of individual childlevel factors on fundamental motor skill development

Physical development at the individual level provides the foundation for motor development. The 3-6 year old stage is a time of rapid growth for the musculoskeletal system, and muscle strength, balance and hand-eye coordination are all developing rapidly. Cognitive and executive functions in children directly affect motor imitation, rule understanding and skill learning. The hypoxic high-altitude environment may reduce children's exercise tolerance and limit their participation in moderate-to-vigorous physical activity, thus indirectly reducing the quantity of motor practice. Physical fitness can be viewed as an external expression of motor ability and is a prerequisite for learning FMS; to some extent, the level of physical fitness reflects the developmental stage of children's basic motor skills.

4.2. Effects of the family environment on fundamental motor skill development

The family is the first place for young children to exercise. Parents' awareness and the quality of caregiver-child interaction positively affect the quality of motor practice. Some caregivers do not pay much attention to motor development and believe that motor skills will improve naturally with age. A heavy workload reduces the time for joint physical play between parents and children. Tibetan household chores and traditional folk games can offer some good motor-exercise opportunities. Due to the cold plateau weather, caregivers limit the time children spend outdoors to maintain warmth and safety, thus reducing exercise opportunities. The Economic Level of a family and childcare arrangements can also affect children's movement skills.

4.3. Effects of kindergarten physical activity environments on fundamental motor skill development

Kindergartens serve as the primary places for 3-6-year-old children to learn basic motor skills. Teacher professional ability, equipment availability and curriculum design together affect the accumulation of children's motor experience. Some preschool teachers lack specialized training in FMS instruction. Outdoor activities are mainly unstructured free play, such as running, jumping and climbing; there is a lack of organised teaching for object control skills. Cold autumn and winter in the high plains, along with a lack of ball equipment and indoor activity spaces in kindergartens, limit all-around motor exercise. In addition, some kindergartens focus on language and cognitive training at the expense of gross motor development, thereby worsening the developmental deficiency in object-control skills.

5. Discussion

The Test of Gross Motor Development-3 (TGMD-3) was used to assess the fundamental movement skills (FMS) of 204 Tibetan children aged 3-6 years recruited from a kindergarten in City L, Xizang, in this study. Systematically studied the development of locomotor and object-control skills in young children living in high-altitude areas, analysed age- and gender-related differences in development, and explored the underlying factors affecting it from individual, family, kindergarten, and high-altitude environmental perspectives with supporting interview data. The results showed that the overall mastery rate of basic movement skills for Tibetan children aged 3-6 in Xizang was only 42.6%, which is relatively low. Locomotor Skills outperformed Object-Control Skills. Fundamental movement skills increased with age, and there was no difference between men and women. The above results support the general rules of children's motor development and also show special features caused by the high-altitude environment, ethnic parenting culture, and actual circumstances

in local preschool education.

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Disclosure statement

The authors declare no conflict of interest.

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